the OIL AND GAS JOURNAL

41
MAR 28 1941
Science Library

ARCH 27
1941

NNUAL
EFINERY
NUMBER

plete survey of
ts and personnel
e United States,
ada and Mexico

PRICE
O CENTS

IN 1908 the wagon peddler was almos the only source for her purchases. Today no longe isolated from modern town and city shops, thanks t the family car—the automobile has brought a new an better way of living. With the automobile and its many blessings, came a new Industry—Natural Gasoline. From the first Hanlon plant built in 1908 with a few bar rels capacity, Hanlon-Buchanan now supplies daily thousands of barrels uniform high quality Natura Gasoline for domestic, coastwise and foreign markets

STA-VOL-ENE
STABILITY ◆ VOLATILITY ◆ ENERGY
IT'S A "NATURAL"

Hanlon-Buchanan, Inc
PIONEER NATURAL GASOLINE MANUFACTURER

EXPORT TERMINALS:
Goodhope, Tex. Corpus Christi, Tex.
Houston, Texas Texas City, Texas
Beaumont, Texas Port Arthur, Texas

TULSA, OKLAHOMA
NATIONAL BANK OF TULSA BUILDING
PHONE 2-1111 or L.D. 388 WIRE OR WRITE P. O. BOX 1559
Cable Address: STA Tulsa, U. S. A.

FOREIGN REPRESENTATIVE:
Rowe, Williams & Co., Ltd.
4 Lloyd's Ave.
London, England

KEYED TO THE HOWCO TESTER
As the ROSETTA STONE revealed the secrets of ancient Egyptian civilization, so does the HOWCO TESTER reveal the secrets of a formation by translating guesswork about its productivity into accurate KNOWLEDGE . . . without incurring the expense of setting casing or the restrictions that such casing may later impose. Practical, performance-proved — available everywhere.
HALLIBURTON OIL WELL CEMENTING COMPANY

The Oil and Gas Journal

PUBLISHED WEEKLY BY THE PETROLEUM PUBLISHING COMPANY AT TULSA, OKLAHOMA

HOME OFFICE, 211 S. CHEYENNE, TULSA
PHONE 3-6291

P. C. LAUINGER, *President* — *Editor*, C. O. WILLSON

E. KLAPPENBACH, *Vice President* — LYNN M. NICHOLS, *Managing Editor*

S. H. ROURKE, *Business Manager* — W. T. ZIEGENHAIN, *Refinery Editor*

M. L. DURHAM, *Circulation Manager* — W. V. HOWARD, Ph.D., *Field Editor*

Associate Editors

HARRY F. SIMONS — T. P. SANDERS

D. H. STORMONT — PAUL REED

H. STANLEY NORMAN — ROBERT INGRAM

W. L. NELSON, *Technical Editor*

District Editors

Houston, *617 Caroline St.*
NEIL WILLIAMS — F. L. SINGLETON

Fort Worth, *Petroleum Bldg.* R. MARNE SANFORD

Shreveport, *City Bank Bldg.* GEORGE WEBER

Los Angeles, *Union Oil Bldg.* L. P. STOCKMAN

Washington, *Natl. Press Bldg.* HENRY D. RALPH

Saginaw, *News Bldg.* O. C. PRESSPRICH

Denver, *State Office Bldg.* TOLBERT R. INGRAM

New York, *415 Lexington Ave.* J. P. O'DONNELL

Oil City, *Derrick Bldg.* A. C. MacINTYRE

Chatham, Ontario, *35 Stanley Ave.* VICTOR LAURISTON

Advertising

LLOYD CAIN, *Advertising Manager*

KENNETH J. LANGLEY, **New York, *415 Lexington Ave.***

HOWARD MARKT, **Cleveland, *Leader Bldg.***

C. R. FARMER, **Chicago, *105 W. Madison***

MITCHELL TUCKER, **Tulsa, *211 S. Cheyenne Ave.***

WAYNE RIVES, **Houston, *617 Caroline St.***

J. HOWARD TINKHAM, **Los Angeles, *1406 S. Grand Ave.***

A. J. CHAMBERS
Twickenham (Middlesex) England—*72 Cole Park Road*

Table of Contents

Vol. 39, No. 46 — March 27, 1941

News Developments

Trends: Changes in Markets Reflect Variations in Operating Status ... 51
Refiners Stand Girded for Any Emergency ... *W. T. Ziegenhain* 52
Refining Capacity, Number of Plants Show Slight Gain ... *D. H. Stormont* 54
Sparks From the News ... 56
Federal Board Asks Authority to Curb Use of Natural Gas ... *Henry D. Ralph* 57
Two-Zone Completions Feature A.P.I. Meeting at Amarillo ... *Paul Reed* 58
News From the State Capitals ... 60
Editorial: Frozen Economy ... 61
Balanced Program Promises Record A.A.P.G. Attendance ... 62
Crude Deliveries Increase From Principal Supplying States ... 66
A.P.I. Raises Estimate on Reserves Half Billion Barrels ... 66
Deaths ... 66
Markets ... 66
Bureau Sees 10 Per Cent Increase for Gasoline ... 68
Cut Ordered in Rail and Pipe-Line Rates for Transporting Gasoline ... *Henry D. Ralph* 71
Miocene Development Looms in Inglewood Field, California ... 73
Refinery Expansion, Natural Gas and Natural Gasoline ... 75
Programs and Meetings ... 76
Pipe-Line Activity ... 210
Summary of Operations, All Fields, February ... 242

Refining Section

The Texas Co. Completes New Motor Laboratory ... *J. J. Mikita and C. E. Cummings* 78
Standard Oil Co. (Indiana) Builds Complete Laboratory ... *D. P. Barnard and A. H. Fox* 82
Chemistry in Petroleum Refining ... *L. N. Leum* 85
First Commercial Hydroforming Plant Now in Operation ... *D. J. Smith and L. W. Moore* 87
Refinery Gadgets ... 92-118
Trends in Refining ... 101 and 109
Maintenance of Large Pressure Storage Vessels ... *D. E. Larson* 121
Equilibrium Constants for a Gas-Distillate System ... *C. H. Roland, D. E. Smith and H. H. Kaveler* 128
Turner Valley Natural Gas and Crude Oils: A Refinery Evaluation ... *Davis Read, Jr. and Gustav Egloff* 142
Lion Oil Controls Skimming, Cracking From One Room ... 147
Laboratory-Controlled Reflux Distillation Apparatus ... *R. W. Harkness and R. E. Bland* 148
Refiners Show Increasing Use of Electric Power ... *W. H. Stueve* 153
Unusual Properties of Houdry Cracked Products Revealed ... *H. P. Broom* 161
Personnel of United States Refineries ... 167
Personnel of Refineries in Canada ... 187
Personnel of Refineries in Mexico ... 188
Refineries Operating in United States ... 189
Shutdown Plants in United States ... 193
Refineries in Canada ... 194
Refineries in Mexico ... 194

Engineering—Operating

Portable Spudders Used for Deepening Wells at Salem ... *Harry F. Simons* 198
Experimental Investigation of Gas-Well Gaging in Monroe Field ... *D. J. Grady, Jr., and A. L. Vitter, Jr.* 200
Questions on Technology ... *W. L. Nelson* 208

Field Developments

Field Developments ... 213
North Central Texas ... *R. Marne Sanford* 214
Indiana, Ohio, Kentucky ... 216
California ... *L. P. Stockman* 217
Texas Gulf Coast ... *Neil Williams* 220
Oklahoma ... *Robert Ingram* 222
Among Drilling Contractors ... 224
Kansas ... *Robert Ingram* 226
Forest City Basin ... 226
N. Louisiana, Arkansas ... *George Weber* 228
Illinois ... 230
Southwest Texas ... *F. L. Singleton* 231
Permian Basin, Panhandle ... *R. Marne Sanford* 233
Eastern Texas ... *R. Marne Sanford* 235
Rocky Mountain Area ... *T. R. Ingram* 236
Appalachian Fields ... 238
Louisiana Gulf Coast ... *F. L. Singleton* 239
Canada ... *Victor Lauriston* 240
Michigan ... *Otto C. Pressprich* 241
Mississippi ... *George Weber* 244

Markets and Prices

Crude Prices ... 244
Group 3 Market ... *H. Stanley Norman* 248
New York Market ... *J. P. O'Donnell* 249
A.P.I. Refinery Report ... 249
Tank-Wagon Market ... 250
Refinery Prices ... 251

Additional Features

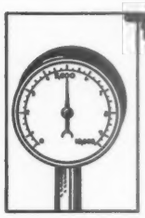
Record of Oil Securities ... 245
Person Paragraphs ... 246
Equipment News ... 252
Classified Advertising ... 254-255
Advertisers' Index ... 256

SUBSCRIPTIONS: United States, 1 year, $6.00; 6 months, $3.00. Elsewhere 1 year, $7.00; 6 months, $3.50. SINGLE COPIES: 20 cents each. Back copies, when over a year old, 50 cents. CHANGES OF ADDRESS reaching the Tulsa office of the Journal by Saturday take effect with the following issue.

Copyright, 1941, by The Petroleum Publishing Company

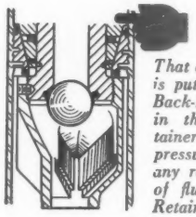
YOU DON'T HAVE TO KEEP YOUR FINGERS CROSSED When Doing a Squeeze Job with a BAKER CEMENT RETAINER

When you're doing an important squeeze job, it's a mighty good feeling to know that the tool you ran in the hole will do its work and do it properly. That's why superintendents who have the responsibility of seeing that squeeze cement jobs turn out successfully like to run Baker Cement Retainers. When a Baker Cement Retainer is on the job, they are sure of three important things:



That the cement can be put away at the necessary pressures, and the Cement Retainer will remain securely set and packed off.

That fluid can be bled off (through the Circulation Joint) at any time during circulation or cementing operations.



That after the cement is put away, the Ball Back-Pressure Valve in the Cement Retainer will hold the pressure and prevent any return movement of fluid through the Retainer.

NOT AN EXPERIMENTAL TOOL

It is important to realize that the Baker Cement Retainer is in no sense an experimental tool . . . it has been used successfully in thousands of oil wells in fields throughout the world. The original Baker Cement Retainer was invented (and the name "Cement Retainer" originally coined) some 30 years ago, and the present tool embodies the knowledge and experience gained during that time in both manufacturing and running many Cement Retainers.

It is in this accumulation of skill and experience that goes with every Baker Cement Retainer run into the hole today, and is the reason why . . . *you don't have to keep your fingers crossed when a Baker Cement Retainer is doing your squeeze job.*

BAKER OIL TOOLS, INC.

Main Office and Factory: 6000 So. Boyle Avenue
P. O. Box 127, Vernon Station, Los Angeles, California
Central Division Office and Factory: 6023 Navigation Boulevard
P. O. Box 3048, Houston, Texas
Export Sales Office: 19 Rector Street, New York, N. Y.

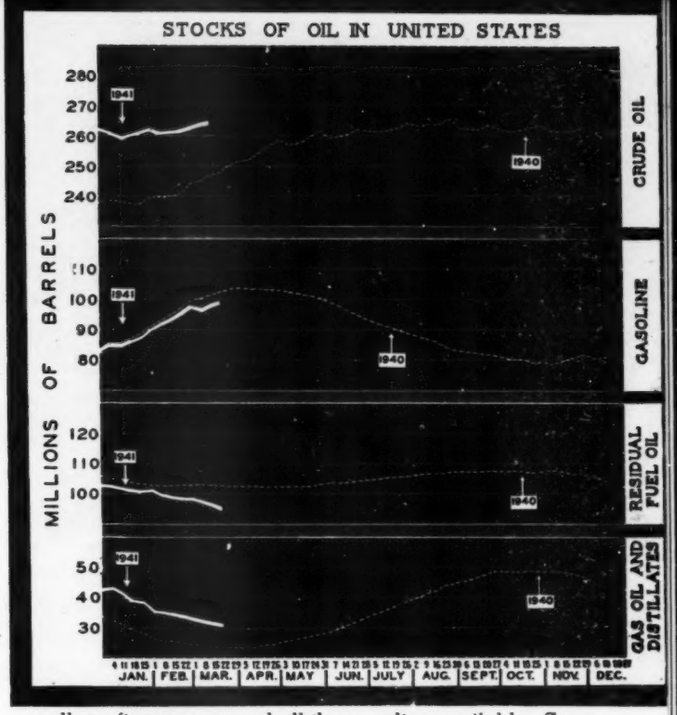
IMPORTANT CEMENT RETAINER APPLICATIONS:

Re-Cementing • Cementing Behind Sections of Pipe • Reducing Gas/Oil Ratios • Series Cementing Plugging off Bottom Fluids • Plugging Back to Upper Zones • Testing Upper Cased Formations Squeeze Jobs • As a Heaving Plug • As a Bridge Plug at any Place in Casing or Liner

BAKER CEMENT RETAINER

Trends

Changes in Markets Reflect Variations In Operating Status



CURRENT reports covering production and inventories and trends in marketing reflect the unusual conditions with which the industry is confronted in balancing its operations. In general, interior markets are stronger than those at coastal points and the price developments are supported by the data on supply, demand and stocks. Gasoline has strengthened in the Mid-Continent and the Middle West with the feeling that further price improvement will materialize over the next 30 days. The crude situation in those areas is termed "tight" with many willing to predict that posted schedules in Illinois will be advanced soon. By summer it is predicted the disparity between Mid-Continent and Illinois prices, taking into consideration the differences in transportation costs between the two areas in shipments to midwestern and eastern markets, will be equalized with higher Illinois postings.

CRUDE PRODUCTION *3,685,380 bbl. daily average—up 8,675 bbl. One year ago 3,885,061 bbl.*

CRUDE STOCKS *264,304,000 bbl. as of March 15—up 303,000 bbl. One year ago 246,762,000 bbl.*

GASOLINE STOCKS **99,541,000 bbl. as of March 22—up 562,000 bbl. One year ago 102,428,000 bbl.*

RESIDUAL FUEL-OIL STOCKS *95,589,000 bbl. as of March 22—down 1,072,000 bbl. One year ago 102,939,000 bbl.*

GAS OIL AND DISTILLATES *30,595,000 bbl. as of March 22—down 1,048,000 bbl. One year ago 23,537,000 bbl.*

REFINERY RUNS *3,655,000 bbl. daily week ended March 22—up 105,000 bbl. One year ago 3,560,000 bbl.*

*Includes 6,438,000 bbl. of aviation fuel.

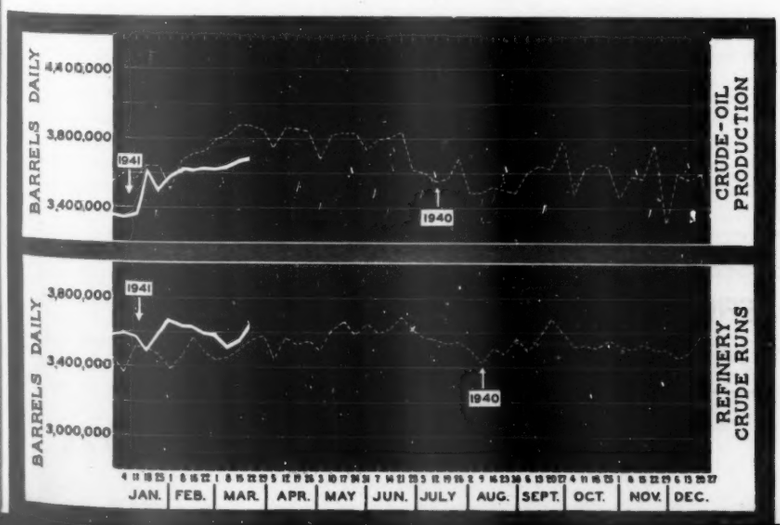
The decline in Illinois production compared to a year ago is bringing changes from week to week in Oklahoma and Kansas. The south-bound movement of crude oil from these states is decreasing steadily as the demands to the north expand. Producing and crude-purchasing organizations in these two states which last year had surplus crude to dispose of to smaller refiners now need all the supplies available. Some of these smaller refiners are now actively soliciting new crude connections. This development probably accounts for the improvement in spot gasoline sales which is largely determined by the operating position of these companies.

The situation in Texas and parts of Louisiana is not as favorable as that of the states to the north. Coastal exports of crude oil and products have dropped to the lowest point in several years. The substantial increase in imports to Atlantic seaboard points is also directly reflected in the Gulf Coast operations. The recent upturn in tanker rates which point to a long period of high costs in water shipments is another unfavorable factor from the standpoint of those who look to the Gulf Coast for outlets.

DAILY AVERAGE PRODUCTION FOR WEEK

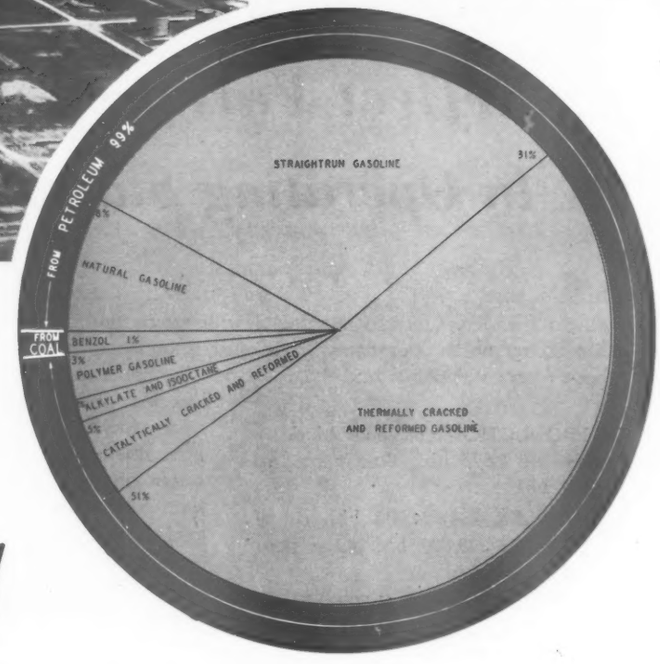
	Mar. 22, 1941	Bur. Mines Mar. est. of demand	March state allowables	Mar. 15, 1941
Arkansas	71,210	69,700	69,969	70,805
California	610,250	596,400	571,500	626,250
Eastern fields	117,200	119,100	.....	115,820
Illinois	325,625	335,200	.....	325,180
Kansas	216,000	194,200	198,200	206,450
Louisiana	304,570	291,300	308,190	298,070
North Louisiana	*70,520*	.....	.....	*69,020*
Louisiana Gulf Coast	*234,050*	.....	.....	*229,050*
Michigan	37,945	47,700	.....	39,725
Mississippi	18,435	20,300	.....	19,150
Nebraska	3,850	3,200	.....	3,400
New Mexico	110,990	103,900	110,000	110,720
Oklahoma	402,150	437,400	400,000	398,675
Rocky Mountain states	100,380	109,700	.....	102,300
Texas	1,366,775	1,327,400	1,352,489	1,360,160
East Texas	*374,375*	.....	.....	*374,575*
West Texas	*240,675*	.....	.....	*240,075*
North Central Texas	*132,100*	.....	.....	*132,410*
East Central Texas	*77,570*	.....	.....	*76,575*
Texas Panhandle	*77,525*	.....	.....	*68,225*
Texas Gulf Coast	*371,000*	.....	.....	*372,750*
Southwest Texas	*93,350*	.....	.....	*95,550*
Total United States	3,685,380	3,655,500	.....	3,676,705
Total production, Jan. 1-Mar. 22, 1941		264,951,370 bbl.		
Same period last year		274,918,713 bbl.		

The seriousness of these developments, over which the operators themselves have no direct control, has not been helped by the conservation and proration bodies at Austin and Baton Rouge. Production in these two states since the first of the month has been greater than the Bureau of Mines recommendations. In Texas there has been a resumption of the old policy of special allowables with the usual effects. The inventory data showing increases in crude-oil stocks at several points in Texas over the past 30 days are the result. Those in close touch with this situation predict local price weakness if this proration policy continues.



Left: Looking east upon Pan American Refining Corp.'s 97,000-bbl. plant at Texas City, Tex. Units appear in following order: Hydroformer, No. 3 cracking unit, catalytic polymerization unit, No. 2 cracking unit, power house and No. 1 cracking unit

Below: Sources and types of motor fuel now manufactured in the United States. Sixty per cent of our automotive and aviation gasoline is synthesized from petroleum hydrocarbons



The refining industry will supply still better automotive and aviation fuels in whatever quantities demanded, and will provide basic chemicals for peace or war. By whatever standards judged,

Refiners Stand Girded for Any Emergency

By W. T. ZIEGENHAIN

THE refining industry in the United States is turning out finished products at the rate of 3½ million barrels a day. The quantity, too large to be visualized as a single mass, could better be expressed as equal to the contents of a train of ordinary tank cars reaching from Washington, D. C., to Philadelphia, Pa. Yet the refining industry in the United States represents only 59 per cent of the total in the world. If the latter were expressed in terms of loaded tank cars, the world train would extend from Washington, D. C., through Philadelphia and on to New York City.

These plants are scattered among every civilized nation and in this country alone, 459 of them are operating in 36 of the 48 states. In the United States the refineries of relatively large unit capacity are segregated in six groups, while plants of less than average capacity are operating in every major oil-producing center in the country. The location of any refinery and the designation of its size are determined pretty largely by the cost of transporting crude oil to the plant and the transporting of the finished products to market. There is no monopoly of refining processing methods or technique. However, technological changes are coming about so fast with respect to processing methods which in turn require relatively large expenditures of money, that a concentration of refinery capacity appears most economical.

In the past year we have witnessed a "speed-up" in the technological program of refining. It has been encouraged by the prospect of supplying much larger quantities of 92 to 100-octane aviation gasolines. If the automobile industry continues its program of building car engines of ever-increasing average compression ratio, the refining industry will no doubt make the higher-octane fuels demanded. Likewise, if the aviation engineers say they need 92 or 100-octane fuels to propel the fleets of planes they are to produce for military or commercial work, the refining industry will meet the demand. But, while these things are practicable, substantial additions must be made to refinery investments and proportionately higher prices must be realized from the products. At this date refiners generally complain that prices are far from commensurate with the development costs incurred in manufacturing the relatively small quantities of very high-octane gasoline needed. They say they are being caught between the demand on the part of automotive engineers for fuels of still higher octane value and the necessity of keeping prices down to assure the normal expansion of petroleum consumption. The refiner operating a plant of less than 5,000 bbl. daily crude capacity can not now foresee the faintest justification for his considering the addition of an alkylation unit, catalytic cracking plant or going further into pyrolytic or catalytic reforming to match the octane values capable of being established by refiners who operate or will add such units in 25,000-bbl. plants or larger. The issue is not new to the refining fraternity and in fact the so-called "octane race" has been in progress for more than 10 years. But with each succeeding year the squeeze seems to be felt more severely. The question of raising the octane value of the normal refinery gasoline production has meant generally in the past a lowering of the end point on current production, adding more tetraethyl lead or cracking a little harder pyrolytically. In a few of the semismall refineries equipped with pyrolytic cracking units the companies have improved their positions through the addition of low-cost polymerization units.

Now, however, they hear that average ordinary motor-fuel values are likely to reach 85 within the next 5 years and that 100-octane fuel is to be ordered for all new government military craft, whether planes, tanks or trucks. Preliminary estimates indicate that 200,000 engines of all sizes may be involved.

Special Section of the ANNUAL REFINERY NUMBER starts on Page 77

The great bulk of this 100-octane fuel will of course be needed to propel the vast fleets of planes scheduled to be built. The quantity of fuel to be consumed by these will depend entirely upon the extent of their use. No one can now anticipate this, but 2 million barrels of 100-octane fuel will be in storage long before construction of the planes is completed.

The advantages of 100-octane fuel are not new to either refiners or government technicians. An anticipated demand for aviation gasoline was first occasioned by air warfare in Europe a little over a year ago. Refiners in the United States who were able to supply the fuel then expected large quantities of 92-octane and 100-octane aviation gasoline to move from our plants to European and Asiatic points. As the war progressed, it soon became apparent that our refining industry had developed more than the capacity needed to supply current European and Asiatic demands. As a result of not receiving substantial European orders and because of our Government placing an embargo on aviation gasoline moving from the West Coast to Japan, the country found itself with a much greater capacity than needed to supply current domestic demands.

Shortly thereafter, however, the United States announced its present national-defense program. Then the actual and potential output of all types of aviation gasoline were surveyed and these data were correlated with the needs of the defense program. The industry was early advised that some capacity must be added for the production of aviation gasoline and the construction of certain of these units is already well advanced. As a part of the program the industry is commercializing isomerization and alkylation on an ever increasing scale.

Mindful of the tendencies for automobile fuels to advance in octane value also, many refiners are installing cracking and polymerization units of one form or another. At this moment it might be interesting to note the changes in the average octane value of the regular-grade automotive fuels within the past decade. In that time the average A.S.T.M. octane number has risen from 60 in 1931 to 74 today. These data are based upon The Oil and Gas Journal's annual survey of motor fuels sold in the middle portion of the United States. They reflect tests made on samples of gasoline purchased from the same scattered company stations at approximately the same time each year. For purposes of comparison from year to year they appear to adequately reflect changes made in motor-fuel quality throughout the entire United States.

From a review of these data (see drawing below) it soon becomes apparent that predictions of an average octane value on regular-grade gasoline of 85, within the next 5 years, reasonably may be made. It is assumed, of course, that car engines will be more economical and will operate more cheaply as a result of this change and in order to overcome the higher cost of manufacturing the 85-octane fuel over the present 74-octane material.

If the industry accepts 85-octane gasoline as the average rating on its regular grade it also means the industry accepts the synthesis of motor fuels on a greatly expanded scale.

Analysis of Chart

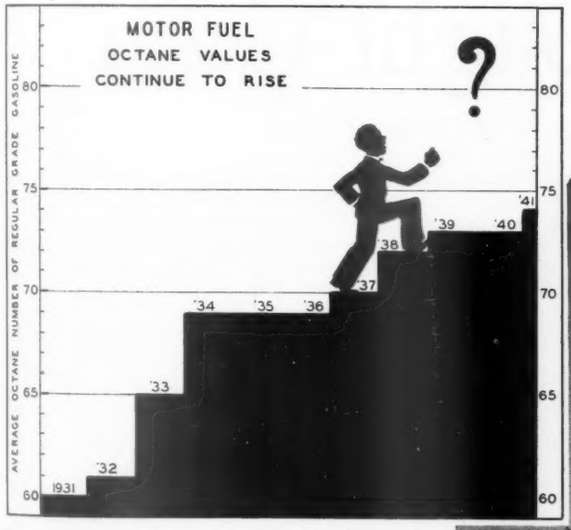
At this point it is interesting to refer to the red circle included on the opposite page. This shows the approximate relative quantities of motor fuel now available in the United States for consumption in automobiles and airplanes. These data represent estimates based upon reports of the U. S. Bureau of Mines and data compiled by Dr. W. H. Hubner of the Ethyl Gasoline Corp. The chart reveals that 99 per cent of this fuel comes from petroleum and 1 per cent comes from coal in the form of benzol. Of this quantity supplied by petroleum, 51 per cent is produced by thermal cracking or reforming. If the demand for gasolines of still higher average octane value continues to rise we might expect to see further expansion of these operations, particularly thermal reforming. This, in turn, will mean that still less straightrun gasoline will be supplied. The output of straightrun has already declined to 31 per cent.

The manufacture of alkylate and isooctane now represents only about 1 per cent of our total motor-fuel output but authorities say this can be expanded to any reasonable quantity.

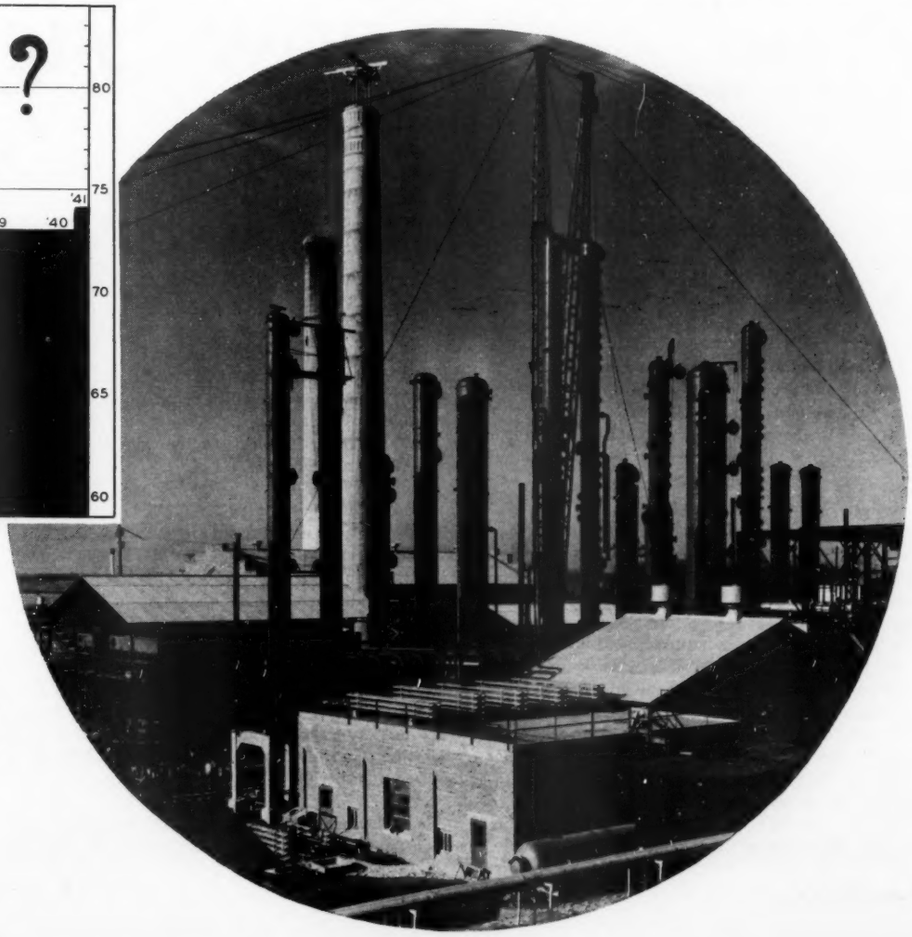
The production of gasoline by polymerization is shown on the chart to represent 3 per cent of our total motor-fuel output. This volume is expected to increase at the expense of straightrun particularly among those refineries of less than average crude capacity.

A further perusal of the chart will show the substantial position assumed by catalytic cracking and reforming. Over the immediate future the catalysis of petroleum hydrocarbons is likely to expand rapidly, particularly among the large refinery units. Recent experimental data, including road tests, permit catalytically cracked gasoline to claim superior qualities when used in motors of relatively high compression ratios and especially when used in conjunction with tetraethyl lead.

The remaining source of motor fuel from petroleum shown on the chart is natural gasoline. At present this represents 8 per cent of our total motor-fuel production. This material is a product of natural gas and is recovered in natural-gasoline plants and delivered to refineries. It does not reflect the total quantity of material recovered from the natural gas and other products which are sold to refineries for manufacture into motor fuel. For example, along with the recovery of 26 and 18-lb. natural gasolines, which are used primarily



Rise in average A.S.T.M. octane numbers for regular-grade automotive gasoline sold in United States. Authorities predict advance next 5 years to point near 85



Construction view Pure Oil Co. polymerization unit at Smiths Bluff, Tex., refinery. Typical of modern fractionation, note high towers of relatively small diameters. Unit will process 13,500,000 cu. ft. cracked gases daily and is expected to be operating by the middle of May

Resins capable of reflecting and transmitting light are made from refinery gases. The synthetic jewels and rod shown above do not represent a large consumption of petroleum but they help to show how crude is more than so much gasoline, motor lubricants and fuel

GROWTH OF REFINERY CAPACITY IN UNITED STATES

	Number of refineries	Total crude capacity (bbl. daily)	Number of operating refineries	Capacity of operating refineries (bbl. daily)	Total cracking capacity (bbl. daily)
1914	176	.....	....	.....	.....
1918	267	1,186,155	....	.....	.....
1919	289	1,295,115	....	.....	.....
1920	373	1,530,565	....	.....	.....
1921	415	1,888,800	....	.....	.....
1922	479	2,164,050	325	1,854,590	.....
1924	574	3,046,790	382	2,549,490	.....
1925	584	3,033,682	385	2,680,052	(*)
1926	515	3,068,340	356	2,770,340	980,960
1927	452	3,224,307	329	2,954,427	1,245,380
1928	456	3,426,330	315	3,116,930	1,327,584
1929	463	3,719,550	341	3,454,250	1,487,950
1930	479	3,972,460	362	3,721,360	1,705,299
1931	500	4,164,080	397	3,913,180	1,844,609
1932	510	4,093,370	383	3,665,830	1,954,550
1933	567	4,125,250	424	3,696,410	1,823,521
1934	628	4,243,033	483	3,790,593	1,838,420
1935	687	4,281,694	496	3,815,470	2,126,620
1936	640	4,301,754	479	3,936,535	2,130,800
1937	603	4,277,860	471	4,038,010	2,172,330
1938	562	4,511,160	451	4,301,910	2,327,215
1939	560	4,461,120	465	4,191,055	2,108,025
1940†	534	4,665,318	462	4,438,658	2,198,300
1941	548	4,816,715	459	4,524,775	2,276,200

*Not available previous to 1926. †Revised.

Refining Capacity, Number of Plants Show Slight Gain

By D. H. STORMONT

THE large amount of construction undertaken by refining companies in the United States during 1940 resulted in raising the crude capacity of refineries to the highest level in the oil industry's history. In the several years previous to 1939 most of the building undertaken was for replacement of equipment already in operation and not for expansion purposes. In 1939, however, the nature of new construction changed so that some 180,000 bbl. of new capacity was added during that year. In the past year refining companies not only continued to replace obsolete equipment, but also added over 150,000 bbl. to the nation's crude-processing capacity.

As of March 1 there were 548 plants with a total crude throughput of 4,816,715 bbl. daily, of which 459 plants with a crude capacity of 4,524,775 bbl. daily were in operation. These data compare with the March 1940 total of 534 plants, with 4,665,318 bbl. throughput, of which 462 with a daily capacity of 4,438,658 bbl. were in operation. The growth in total crude and operating facilities was a continuance of the trend in recent years, but the increase in total number of plants was a reversal of a 6-year downward trend. Total cracking capacity of plants likewise continued to rise, the total on March 1 being 2,276,200 bbl. daily as compared with 2,198,300 bbl. on March 1, 1940.

Not reflected in this survey is the large amount of refinery construction which centered around the addition of polymerization, alkylation, and other equipment for the manufacture of high-octane gasolines. The survey deals only with the capacity to process crude oil and capacity for cracking, while equipment of this type results in improving the quality of the gasoline but does not necessarily increase the throughput of the plants. In addition to the growth in crude capacity, therefore, this gain in facilities to manufacture high-quality gasolines should also be taken into consideration.

Probably the best gage of this growth in facilities for producing high-octane gasolines is reflected by the Bureau of Mines figures on the production of aviation gasoline. In January of this year the bureau reported the total output of aviation gasoline was 1,566,000 bbl., as compared with a production of 952,000 bbl. in January 1940. Or on a daily basis, the production was 20,000 bbl. higher on January 1, 1941, than at that time a year ago. This would indicate that refining companies not only increased their crude and cracking facilities, but also installed over 20,000 bbl. capacity for manufacturing aviation-grade gasolines.

Of this year's total refining capacity of 4,816,715 bbl. daily, 291,940 bbl. were shut down, or about 65,000 bbl. more than was shut down at this time a year ago. While some of this potential capacity is only temporarily out of operation or has been closed only in the past year, much of it has been

to improve the volatility of refinery production, the natural-gasoline industry recovers large quantities of butane and isobutane, which products are being delivered to refineries by pipe line in increasing quantities for processing by alkylation. In accomplishing this, current practices favor the recovery and isolation of isobutane among the larger gasoline plants. If the demand for 100-octane aviation fuel increases substantially we can expect to see the installation of much additional fractionating equipment for its recovery.

Alkylation

The alkylation of isobutane with ethylene, propene and butenes in contact with aluminum chloride, boron fluoride, or sulfuric acid, using relatively high temperatures and pressures, has proven to be an especially practicable commercial operation for the manufacture of 100-octane fuels. Expansion of this practice will, of course, expand the demand for isobutane. This seems likely because alkylate fractions not only possess octane ratings of 95 or higher, but show unusually favorable tetraethyl-lead susceptibility.

Thermal alkylation is reported as operating best when the charging stock is made up of isobutane and ethylene and to make therefrom 2,2-dimethylbutane or neohexane. The sulfuric acid method is used primarily to convert isobutane and butenes to isooctane.

Other Products

While automotive and aviation fuels represent the largest and most important items in modern refining operations, exhaustive studies are being made to develop and supply the highest-quality diesel fuels, solvent-refined and dewaxed motor and industrial oils, moisture-free, high-melting-point paraffin waxes, higher-bearing-strength asphalts and basic chemicals from which hundreds of standard articles of trade may be made. The more important materials include rubber substitutes, glycerin, toluene, and plastics.

Commercial plants are now under construction at three refineries for the conversion of petroleum fractions to rubber substitutes and at least four for the reforming of petroleum to make toluene.

out of operation for 6 years or longer. A portion of this capacity, therefore, cannot rightly be classified as refining facilities as the plants were closed down due to their equipment being uneconomical to operate, or they were poorly located in regard to crude supplies and markets for their output.

Plants which were uneconomical in their operation several years ago, certainly have not improved their status in the meanwhile. And plants without adequate crude supplies or refined markets do not represent capacity unless they are dismantled and reerected at a more favorable site. It is probable, therefore, that of the total shutdown capacity only from one-third to one-half can be rightly classified as refining capacity under present marketing standards and prices. Thus the total crude capacity of refineries in the United States at this time is in the neighborhood of only 4,675,000 bbl. daily.

Fewer Shutdown Plants Added

With the exception of California and Illinois, considerably fewer plants were added to the shutdown list during the past year. This might be expected as the eighty-odd plants once operating in East Texas had practically all been dismantled prior to the first of 1940. While market quotations on refined products throughout the year were generally depressed, they were sufficient to permit refiners to keep their plants in operation. Thus, there was no widespread closing of plants such as took place in 1938. For the nation as a whole, the number of inactive plants increased from 72 to 89.

In California the number of plants on the shutdown list rose from 16 to 30 with a resulting gain in active capacity of almost 35,000 bbl. (from 124,250 to 159,700 bbl.). This increase was largely due to the termination in May 1940 of the arrangement whereby products of these plants were distributed through the Independent Refiners Association. The slackened exports of refined products to Japan and other Asiatic countries likewise affected the operation of California plants.

The increase of eight in the number of closed plants in Illinois was, of course, due to the tightened crude market resulting from the decline in that state's production. Prior to opening of new flush production in Illinois there were only 12 plants listed. As a result of the boom 17 new plants were built, nearly all of the skimming type, so that at one time last summer 29 plants were operating. Since then one has been dismantled and a second was destroyed by fire to reduce the total number to 27 plants.

In the accompanying table listing plant capacities by states it is readily seen that Texas maintained its first place with 112 plants having a total crude capacity of 1,401,650 bbl. daily. Compared with a year ago this represents a gain of three plants and 31,330 bbl. in capacity, of which 22,000 bbl. was accounted for in additions to the eight large Gulf Coast refineries. The remainder of Texas' gain in capacity was accounted for by enlargement programs at operating refineries as there were no new plants of any consequence built during the past year. Throughput of the state's 98 operating refineries was 1,352,550 bbl. daily, about 15,000 bbl. higher than that of the 95 plants in operation in March 1940.

In California there were 87 plants of 970,400 bbl. total capacity, representing a gain of about 8,000 bbl. over a year ago. Due to the closure of 14 plants, though, the active facilities decreased 27,060 bbl. to a total of 810,700 bbl. daily. Three new plants were built in the Santa Maria area, but these were offset by the dismantling of three obsolete plants. No major changes were shown in the crude capacities of individual plants and one of the largest construction programs undertaken was the building of a new 10,000-bbl. refinery.

The survey of refineries in North America, giving the location and type of plant, and listing the crude and cracking capacities, begins on Page 189. Personnel of the refining companies starts on Page 167.

This plant was that of Douglas Oil & Refinery Co. at Wilmington, now under construction.

In the Middle West states greatest gain in capacity was shown by Illinois, which jumped from 204,800 to 259,450 bbl. during the year. Total throughput of Indiana's refineries declined from 240,250 to 219,770 bbl. due to the dismantling of Shell Oil Co., Inc., 30,000-bbl. plant at East Chicago. To offset this decline one 2,000-bbl. skimming plant was built and another 5,000-bbl. refinery is under construction at Indianapolis. Ohio, Kansas, and Nebraska showed small gains in processing capacity while Oklahoma recorded a decline in total crude throughput but a gain in active capacity.

In the eastern states New Jersey led in gained refining capacity with an increase of 26,000 bbl., to bring the state's total crude capacity to 257,700 bbl. daily. This increase was due to enlarged processing facilities at several of the state's seven plants. New York and Pennsylvania likewise recorded gains in both total and active crude capacity due to expansion work at various plants.

Mississippi, which has been absent from the list for several years, was replaced this year. This state had one refinery under construction on March 1, while a second was shut down.

Of the 77,900-bbl. increase in cracking capacity, majority of it was accounted for by new units added in California and Illinois. Texas refineries showed a slight decline, as did several other states, but these drops were more than offset by the 39,000-bbl. increase in California and 53,500-bbl. gain in Illinois.

The survey of Canadian refineries revealed that those companies were carrying on new construction work despite the European war. A gain in total refining capacity of 36,000 bbl. was shown with a drop of one in total number of plants. Capacity of operating plants was 223,100 bbl. daily as compared with an estimated 194,200 bbl. on March 1, 1940. The throughput of shutdown plants increased from 850 to 5,500 bbl., most of which was accounted for in the recent closing of several plants in Saskatchewan Province and one in British Columbia. Cracking capacity of Canada's plants was increased from 93,300 to 95,000 bbl. during the year.

REFINERY OPERATIONS IN NORTH AMERICA

UNITED STATES

State—	No. of plants	Daily crude capacity (bbl.)	Daily cracking capacity (bbl.)	No. of plants operating	Crude capacity operating plants	No. of plants shut down	Crude capacity plants shut down
Alabama	1	4,000	.....	1	4,000	.....	.....
Arkansas	6	39,750	11,500	6	39,750	.....	.....
California	87	970,400	404,700	57	810,700	30	159,700
Colorado	9	15,575	5,900	9	15,575	.....	.....
Delaware	1	3,500	.....	1	3,500	.....	.....
Georgia	1	4,000	.....	1	4,000	.....	.....
Idaho	2	2,300	1,250	2	2,300	.....	.....
Illinois	27	259,450	142,310	19	245,750	8	13,700
Indiana	9	219,770	99,600	9	219,770	.....	.....
Kansas	25	177,150	92,440	22	175,800	3	1,350
Kentucky	9	45,450	19,800	9	45,450	.....	.....
Louisiana	16	212,500	104,000	14	197,500	2	15,000
Maryland	3	42,500	51,050	3	42,500	.....	.....
Massachusetts	2	53,200	55,700	2	53,200	.....	.....
Michigan	31	96,350	23,100	25	88,650	6	7,700
Minnesota	2	6,000	.....	2	6,000	.....	.....
Missouri	2	22,300	6,280	2	22,300	.....	.....
Mississippi	2	6,500	.....	1	2,500	1	4,000
Montana	35	43,370	15,200	30	40,945	5	2,425
Nebraska	6	6,350	600	6	6,350	.....	.....
New Jersey	7	257,700	151,900	6	251,700	1	6,000
New Mexico	12	11,375	3,940	9	8,650	3	2,725
New York	7	71,700	20,400	7	71,700	.....	.....
Ohio	14	162,665	76,700	11	158,600	3	4,065
Oklahoma	31	232,830	103,500	25	210,280	6	22,550
Pennsylvania	31	337,200	130,800	30	334,700	1	2,500
Rhode Island	2	12,500	1,650	2	12,500	.....	.....
South Carolina	1	6,000	.....	1	6,000	.....	.....
South Dakota	4	530	.....	4	530	.....	.....
Tennessee	1	150	.....	.....	.....	1	150
Texas	112	1,401,650	712,900	98	1,352,550	14	49,100
Utah	4	11,200	8,700	3	11,000	1	200
Virginia	1	2,000	.....	1	2,000	.....	.....
Washington	2	3,300	1,500	2	3,300	.....	.....
West Virginia	4	11,700	6,800	4	11,700	.....	.....
Wisconsin	1	5,000	.....	1	5,000	.....	.....
Wyoming	38	58,800	24,400	34	58,025	4	775
Total	548	4,816,715	2,276,200	459	4,624,775	89	291,940

CANADA

Alberta	15	21,200	8,000	13	20,450	2	750
British Columbia	4	25,500	3,400	3	24,500	1	1,000
Manitoba	5	3,850	1,100	4	3,600	1	250
New Brunswick	1	300	.....	1	300	.....	.....
Northwest Territory	1	850	.....	1	850	.....	.....
Nova Scotia	1	32,500	12,500	1	32,500	.....	.....
Ontario	6	58,600	28,600	5	58,000	1	600
Quebec	6	67,300	30,500	6	67,300	.....	.....
Saskatchewan	15	18,500	4,900	9	15,600	6	2,900
Total	54	228,600	95,000	43	223,100	11	5,500

MEXICO

Total Mexico	12	101,795	18,830	12	101,795	.....	.....

SPARKS . . . FROM THE NEWS

GEOLOGISTS' MECCA: A record attendance for the annual meetings of the A.A.P.G. and affiliated organizations is assured for next week at Houston. The accomplishments of this group is the main reason this industry is prepared.

CAUSE AND EFFECT: The Texas Railroad Commission after a good record for 2 months is now permitting crude-oil production to exceed B. of M.'s estimated demand figures for that state. The crude stock reports reflect the effects.

LION'S SHARE: Kansas seems at the moment to be in a position to grab the lion's share of the expected gain in mid-western markets this summer, since Oklahoma is believed to be producing close to capacity. The North Texas areas will be next in line.

GROPING: Attempts to gain support among oil men for a secondary-recovery unit in the Oklahoma City field have revealed that many operators are groping in the dark when it comes to secondary recovery.

SPREADING OUT: Mississippi will get a wider oil play this year if the leasing activity in Jones County is any criterion.

VIEWPOINT: A California buyer reduced crude-oil price schedules to correspond to refinery revenue. "Fine" say the refiners, "heresy" say the producers.

SUPER REFINED: Gasoline imported from Rumania into Germany for use in airplanes is refined as a precaution against contamination at the hands of saboteurs.

MORE: More plants, more capacity and more facilities to manufacture special products are part of the expansion revealed in this Annual Refinery Number. More profits unfortunately cannot be reported.

DELAYED ACTION: The I.C.C. after many delays authorizes substantial reductions in petroleum rail rates out of the Mid-Continent. They would have been more helpful to refiners in that area had they come years ago when first requested.

TERMINOLOGY: Hauling heavy rotary equipment through the bad lands of northwestern Nebraska will probably add to the picturesqueness of American oil-field terminology.

AFTER ALL: The Federal Power Commission wants authority to consider the effects the introduction of natural gas will have on other fuels before authorizing the construction of new lines. After all, why should the wishes of producers and consumers prevail when they conflict with those of a government expert.

MANUFACTURING TREND: A large gasoline plant in the Panhandle which is quitting the manufacture of natural gasoline since it has been revamped to manufacture isobutane, isopentane, and a third-grade gasoline, is an example of a new trend.

VARIATION: Drilling times reported this week range from 8,000 ft. in 24 days to 4,400 ft. in 12 years.

BYPASSING NATURE: The Japanese are making gasoline from sardines. That's a fraud on nature according to some theories on the origin of oil.

OIL IS WHERE—: After many wells have sought oil in the St. Peter in Illinois, the first test in Pennsylvania to that formation, found it.

WEAK COMBINATION: Yugoslavia is the thirteenth power to come under Nazi domination. Considered as a unit this is combination of weakness rather than strength so far as oil is concerned.

REHEARSING SIGNALS . . .

Complete understanding of signals is important to this amateur diver as he prepared to enter 6 ft. of muddy Brazos River water to repair a leak. He worked alone, feeling for the rupture and installing a new clamp. He probably learned things about pipe lines that the I.C.C. never will know

Federal Board Asks Authority To Curb Use of Natural Gas

By HENRY D. RALPH

WASHINGTON, D. C., Mar. 24.—More regulation of the natural-gas industry, possibly including restrictions on use of the fuel where others will serve, was recommended to Congress today by the Federal Power Commission.

In submitting its annual report, the F.P.C. made three speeific requests for additional legislation affecting natural gas, and also suggested that it be given authority to promote conservation by denying permits for new pipe lines and by restricting the use of natural gas by functions rather than by areas.

The commission refers to the applications pending before it for certificates of convenience and necessity to construct new pipe lines to take southwestern gas to industrial areas in the Middle West and East, and declares that such applications raise a serious question of the need for planned control of conservation and of the distribution and use of natural gas. While the commission admits it has no authority to deny certificates on such grounds, the report contains the hint that pending applications may be delayed in anticipation that Congress will give it such authority.

The three specific requests for legislation are relatively minor in comparison with the suggestion for planned economy over the entire natural-gas industry, but they would give the F.P.C. considerably more power over construction of new pipe lines and the rates charged by gas companies. In making these recommendations the report says:

1938 Natural-Gas Act

The enactment of the Natural Gas Act of 1938 extended the commission's jurisdiction to include another important energy resource—natural gas. The act and the work which the commission is doing under it should be considered as a first step in dealing with the conservation of one of the country's exhaustible resources.

Under the act the commission has authority to regulate rates charged for the transportation and wholesaling of natural gas in interstate commerce, to grant certificates of convenience for proposed new pipe lines extending into the market area of existing companies, to direct extensions of existing pipe lines where existing markets will not be adversely affected, and to control the flow of natural gas over the nation's boundaries.

Already, under this legislation, successful steps have been taken to reduce natural-gas rates. But the applications for authorization of new transmission pipe lines raise fundamental issues of conservation which cannot be settled in the public interest without a broadening of the act.

The commission has before it the first proposal to tap the southwestern reserves of natural gas to supply the tremendous markets of the industrial Northeast. This proposal, which will probably be planned initially to deliver more than 150,000,000,000 cu. ft. of gas annually to the New York City area, has already raised the question whether the proposed use of natural gas would not result in displacing a less valuable fuel, creating hardships in an industry already supplying the market, while at the same time rapidly depleting the country's irreplaceable reserves of natural gas. But under the provisions of the act the commission appears to have no authority to consider this important problem.

An even more fundamental question is involved, the question whether rapid depletion of the country's natural-gas reserves may not reduce for all time the country's potentially recoverable reserves of oil. This would have serious implications in terms of national defense.

In order to make possible more effective protection of the public interest in connection with the transportation and sale of natural gas in interstate commerce, the commission offers the following recommendations:

1. Section 7 (c) of the act should be broadened to give the commission control over all new interstate natural-gas pipe-line construction through prohibiting the construction of any new lines utilized in interstate commerce until authorized by a certificate from the commission. The present proviso in the act permitting enlargement or expansion of existing facilities for supplying increased market demands in a company's present market area without a certificate should be retained.

2. The commission should be given the express statutory authority to compile and publish statistics of the natural-gas and manufactured-gas industries comparable with those now compiled and published concerning electric utilities under Section 311 of the Federal Power Act.

3. In order to assure adequate protection of domestic and commercial consumers against unjust or discriminatory rates, the commission's rate-regulatory authority should be extended to sales of natural gas from interstate pipe lines for industrial as well as domestic and commercial purposes. Such authority over sales for industrial purposes should cover direct sales to industries as well as sales for resale to the industrial customers of distributing companies.

The request for more legislation is discussed in more detail in the chapter on regulation of natural gas, highlights of which follow:

Regulation of Natural Gas

With the passage of the act of 1938, the Congress gave recognition to the necessity for federal control of the natural-gas industry to fill the existing gap in the regulatory powers of the state commissions with respect to the sale and transportation of natural gas in interstate commerce. Until the passage of that act, no regulatory body was in existence to which a complaint could be directed or from which information could be obtained concerning the operations of such companies. Interstate natural-gas pipe lines were being developed and operated almost wholly without regulation, and the reasonableness of the rates and charges which they collected could be determined only with great expense and difficulty.

Previous efforts by state commissions to secure information have consequently been directed principally to the investigation of such charges where the rates complained of were between admittedly affiliated companies.

The reports of the F.T.C., undertaken in connection with its study of utility holding companies, showed the widespread control and intricate corporate structure associated with the production and transportation of natural gas.

(Continued on Page 241)

F.P.C. RULES OVER THIS WORK

Pending before the F.P.C. are applications for authority to construct natural-gas pipe lines costing an estimated total of $173,000,000. Two other applications were awaiting action at one time but have been withdrawn and one has been granted. The F.P.C. seeks authority to go beyond the question of public convenience and necessity in formulating its decisions granting or denying permission to build interstate transportation systems for natural gas. The following tabulation shows in general the status of pending applications and their estimated cost:

Kansas Pipe Line & Gas Co., from (Texas Panhandle), Hugoton field, Kansas, to Mesabi iron range, Minnesota—900 miles, pending	$14,550,000
Public Service Gas Co., from Montana and Wyoming to Wisconsin—1,500 miles, withdrawn	49,400,000
North Dakota Consumers Corp., from North Dakota to Minnesota—198 miles, pending	4,250,000
Louisiana Nevada Transit Co., from Cotton Valley field, La., to Okay, Ark.—73 miles, granted	450,000
General Gas Pipe Line Co., from South Central Kentucky to Central Indiana—180 miles, dismissed without prejudice	4,300,000
Ralph R. Willis, from Illinois to Indiana—10 miles, withdrawn	40,000
Tennessee Gas & Transmission Co., from northwestern Louisiana to western South Carolina—1,390 miles, pending	20,300,000
Western Natural Gas Co., from Hugoton field, Kansas, to Milwaukee, Wis.—800 miles, hearings completed—pending	25,200,000
Independent Natural Gas Co., from Texas Panhandle to Milwaukee, Wis.—877 miles, hearings completed—pending	28,700,000
Reserve Gas Pipe Line Co., from South Texas to New York City—1,500 miles, pending	80,000,000
Total	$227,190,000

Two-Zone Completions Feature A.P.I. Meeting at Amarillo

By PAUL REED

AMARILLO, Tex., Mar. 25. — Two-zone well completions, secondary recovery, and various practices of significance in drilling and production operations were considered at the annual spring meeting of the Mid-Continent district, American Petroleum Institute.

A feature of the meeting was the free discussion of subjects presented in the papers dealing with important problems of men directing field operations. From six states came 420 who registered for the 2-day session here March 21 and 22.

C. H. Keplinger, Shell Oil Co., Inc., was presented with a gift at the banquet for his services as chairman of the program committee. George Berlin, Skelly Oil Co., Pampa, Tex., was elected chairman for the district, succeeding T. J. Hamilton, independent operator, Oklahoma City, Okla. Other officers elected for the coming year are: L. R. Pickrell, vice chairman, Kansas, T. C. Johnson, Inc., Wichita, Kans.; Herbert Goodpaster, vice chairman, Oklahoma, Kerlyn Oil Co., Oklahoma City, Okla.; R. C. Kay, vice chairman, Panhandle, independent operator, Amarillo, Tex.; and H. W. Ladd, secretary-treasurer, Stanolind Oil & Gas Co., Tulsa.

Federal Control Condemned

In speaking of the situation which the industry faces, H. M. Stalcup, Skelly Oil Co., Tulsa, said:

"We find the oil industry—as vitally important as steel in national defense—without a semblance of a shortage or bottleneck in its entire structure. . . . All of this has been done without asking, receiving or wanting one copper cent from government in the way of a subsidy, direct or indirect; but upon the other hand has been wholly accomplished under the truly American system of free enterprise and private initiative.

"In the light of these facts then, what logical reason is there for the continued demand for some type of federal legislation to regulate, control or take over the oil industry? I contend there is absolutely none.

"In view of the outstanding state of preparedness in each and every branch of the oil industry, one would logically conclude that our national administration, burdened as it is with its own countless problems, would be relieved to know of at least one major industry of vital importance to the nation, either at peace or at war, which is in such an enviable position. But such is not the case. Hardly a week passes without a renewal of the demand for federal control of the industry.

"It is significant that the demand for such drastic and un-American legislation stems from and is practically confined to one certain individual; none other than Harold L. Ickes, secretary of the interior, whose notable characteristic seems to be an exalted ego and an inordinate, consuming, burning desire for more and more bureaucratic, czaristic power.

"At first this demand was predicated on an exaggerated claim of terrible waste existing in the production of this most essential and irreplaceable natural resource. Exhaustive congressional investigations, including the forthright testimony of governmental employes, themselves, completely exploded this claim, and it was definitely shown that preventable waste in the industry had been brought to an almost irreducible minimum.

"Now, the claim has been shifted to another popular approach; that federal control is required in the interest of national defense. Such a claim is equally unjustified by the facts in the case, and easily demonstrable to any intelligent, fair-minded person."

Mr. Stalcup compared the situation at the time of World War I with the present to show the progress which has been made by the industry to the point where it can furnish ample petroleum supplies.

"Today," he said, "depending upon one's viewpoint, we are either already indirectly engaged in World War II or dangerously, perilously near becoming directly engaged therein. In any event, we are belatedly engaged in the most gigantic program of preparedness the world has ever seen, either to defend our country in combat or assure our continued peace by reason of becoming thoroughly armed. I am certain we all are still devotedly hopeful that with complete preparedness and all-out aid to Britain we can escape actual war and continue to enjoy, as no other nation on earth has, the blessings of peace."

At the banquet at the close of the convention, E. De Golyer, referring to himself as an independent, emphasized the importance of the points made by Mr. Stalcup. He called upon the heads of major companies such as W. S. Farish, Standard Oil Co. (New Jersey); Alexander Fraser, Shell Oil Co., Inc.; F. A. Leovy, Gulf Oil Corp.; Starr Rodgers, Texas Co., to assume the leadership which the industry needs in this crisis.

After describing the operation of proration as it is practiced in Kansas, Andrew F. Schoeppel, chairman Kansas Corporation Commission, said that most producers, whether large or small, are willing to go along with state control of the oil industry. Many adjustments had to be made, he added, to conform to this order in all states having conservation laws and practices and likewise many of these producers now feel that great losses would follow if the present program were again changed to meet some form of federal control. Something more than lip service must be given to proration and conservation under state laws by all concerned, if enjoyment of benefits is to continue.

Two-Zone Production Methods

It was regarded as significant that Mr. Schoeppel was present at the symposium on two-zone well completions conducted after delivery of his paper. There followed a free discussion of the proposal to have state regulations permitting production from two zones through one well. Since this matter is coming up for early consideration in Kansas as well as in several other states the forum provided an opportunity for informal discussion of different points of view on this subject in the presence of a state official who must reach a decision regarding this practice in the near future.

Discussion was directed by A. S. Ritchie, McPherson Drilling Co., who mentioned that recently the two-zone method of producing has received special attention in Kansas. It permits continual production through one well from multiple sands which individually produce at a rate too low to justify separate wells. By perforating casing at the upper zone and by equipping the well with packer and tubing for this type of operation, it

Left: Left to right, George Berlin, Skelly Oil Co., new chairman of the district, breakfasting with T. J. Hamilton, retiring chairman, and Herbert W. Ladd, new secretary-treasurer

Right: Informally discussing a paper are, left to right, R. R. Moscrip, Shell Oil Co., Inc.; H. M. Stalcup, Skelly Oil Co.; C. H. Keplinger, Shell; Herbert Goodpaster, Kerlyn Oil Co.

is possible to produce from one formation during one part of the month and from the other formation at another part of the month.

E. O. Bennett, Continental Oil Co., vice chairman of the symposium, discussed experiences of his company with two-zone methods. He mentioned three-zone completion practices in California and two-zone completions in Indiana, Illinois, and Louisiana. In his opinion, millions of dollars could be saved by multiple-zone methods which would prevent premature abandonment. After describing two-zone practices followed by his company in the Ville Platte field, Louisiana, he called for a general discussion. Russell S. Knappen, C. H. Keplinger, Floyd Pickerell, Paul McGivern and Wendell Jones responded.

Various difficulties confronting the state in enforcing two-zone regulations were brought forward as well as possible means for dealing with them. At the end of the discussion the opinion was expressed that the state would need more men to enforce regulations necessary for two-zone operations but that the extra expense would be justified in the saving in cost of additional wells and by the possibility of producing from two zones in the early life of a property before casing is badly corroded.

Left: Discussion following symposium on two-zone completions, left to right, E. O. Bennett, Continental Oil Co.; Colin C. Rae, Skelly Oil Co.; Russell S. Knappen, Gulf Oil Corp.; A. S. Ritchie, McPherson Drilling Co.

More than usual attention was directed toward secondary recovery. The first morning was devoted to papers on this type of operation. Since little information has been available regarding his territory, Prof. Clark F. Barb, Colorado School of Mines, in "Secondary Recovery in the Rocky Mountain Region," furnished needed data. In this producing area there are seven or eight gas-repressuring projects and one air-repressuring operation. He said: "There had been no attempt at water flooding up to the end of 1940. Lack of detailed knowledge of flooding technique is possibly one reason but lack of water and high development costs have also had a retarding influence."

The major water-flooding areas of the Mid-Continent were discussed by L. M. Arnold and R. C. Earlougher, both of Geologic Standards Co., in papers which dealt with the practices in Oklahoma and Kansas. These papers furnish material which will be useful for reference by those studying such operations. In these papers attention was directed to the following points:

"In addition to establishing large new oil reserves, results to date indicate that many of the shallow areas of northeastern Oklahoma are adaptable to water flooding. It also seems safe to predict that this method of secondary-recovery operation will prove equally adaptable in some of the deeper productive horizons in the state. . . .

"Probably the most significant developments in water-flooding operation in Kansas are first the wide use of old wells as producers; and, second, the practicability, under certain conditions at least, of using as wide a spacing as 660 ft., water well to water well and oil well to oil well. These two factors are of special economic importance in that when used together they result in a great saving in development and operating costs. . . ."

Water Used With Gas

In "Repressuring in Kansas," L. L. McWilliams, Phillips Petroleum Co., surveyed the practices employed in southeastern Kansas. In closing, he said:

"An interesting development which is increasing in application is the injection of small volumes of water along with the input gas. The essential idea is to reduce the movement of gas through the more permeable streaks of sand. Although this practice is still in the experimental stage, it is known that in one instance the gas-oil ratio of wells offsetting the input wells was reduced and in another instance the oil production on offset producing wells is reported increased."

Right: Left to right, Carl Young, secretary, Production Division, A.P.I.; R. C. Kay, independent operator; H. E. Miller, Lario Oil & Gas Co.; J. C. Johnson, Continental Oil Co.

In "Gas-Well Acidizing in the Texas Panhandle," Gilbert L. Leach, Dowell, Inc., said: "Acidizing is an indispensable step in the completion of gas wells in the Texas Panhandle. Perhaps no other area and no other drilling or producing procedure offers a more direct challenge to the engineering ability and ingenuity of both operators and service companies. However, few investments are so secure or pay out so quickly. Poor wells, both old and new, are made into good ones, and good producers develop into excellent ones."

In the discussion which followed, E. N. Armstrong, Shamrock Oil & Gas Co., cited results obtained by his company showing profitable experience with acidizing.

Using 100 slides, G. Raymond, Black, Sivalls & Bryson, Inc., illustrated "The Installation and Maintenance of Oil Field Tanks," which showed good and bad practices as well as improvements which are possible in the future.

The subject of the "Care and Maintenance of Diesel Engines" was handled in papers by George P. Fenn and T. M. Fahnestock, Caterpillar Tractor Co., and by discussion prepared by C. L. McMullen, Buda Co., in which practices were recommended for keeping down operating costs.

E. D. Wilde, Guiberson Co., reviewed field practices in "The Application of Gas Lift to Modern Production Methods."

Charles Rodd, Gulf Oil Corp., presented an engineering study of "Determining Potentials by Drawdown Methods."

"Gel-Cements and Their Application in Oil-Well Cementing Operation," was presented by Cedric Willson, Trinity Portland Cement Co.

"Oil-Well Cementing Practices in Kansas," was the subject of the paper by George T. Hoisington, Halliburton Oil Well Cementing Co.

E. R. Albert, Jr., Baroid Sales Division, National Lead Co., discussed "Mud Control as an Aid in Mid-Continent Drilling."

A. H. Mitchell, Carter Oil Co., in "Personnel Relations in the Oil Industry," said:

"A good personnel-relations program is designed to accomplish six things. Three for the employer and three for the employe. The first item of importance is to find the right man; the second to retain the right man; and the third to terminate the right man. These first three are the items designed to help the employer. The next three are for the employe. First, to pay satisfactory wages; second, to provide job security; and third, to provide an opportunity for the employe to discuss his problems or grievances with his supervisor."

Members elected to the advisory committee are: Henry E. Miller, chairman, Lario Oil & Gas Co.; M. N. Perkins, Phillips Petroleum Co.; E. O. Bennett, Continental Oil Co.; George Hoisington, Halliburton Oil Well Cementing Co.; W. B. Berwald, Ohio Oil Co.; J. S. Freeman, Skelly Oil Co.; T. J. Hamilton, independent; N. M. Hutchinson, Cities Service Oil Co.; J. H. Stewart, Atlantic Refining Co.; T. C. Johnson, independent operator; C. F. Alford, Humble Pipe Line Co.; M. J. Kirwan, I. T. I. O.; D. R. Knowlton, Phillips; N. H. Lynn, Kerlyn Oil Co.; M. N. Mahaffey, Cities Service; H. V. Matthews, Stanolind Oil & Gas Co.; Earl Blackburn, J. M. Huber Corp.; John Millar, Sinclair Prairie Oil Co.; J. F. O'Shaugnessy, Lario; M. Harrell, Texas Co.; W. G. Ricketts, Amerada Petroleum Corp.; A. S. Ritchie, McPherson Drilling Co.; R. S. Knappen, Gulf Oil Corp.; C. D. Watson, Carter Oil Co.; H. E. Zoller, Derby Oil Co.; C. H. Keplinger, Shell Oil Co., Inc.; C. O. Moss, Deep Rock Oil Corp.; Walter Biery, Sinclair Refining Co.; A. J. Beagle, Rock Oil Co.; W. M. Saxon, Pure Oil Co.; Frank Pickell, Stanolind.

STATE CAPITALS...

ARKANSAS

FOLLOWING A STATE-WIDE HEARING held in Magnolia March 21, the Arkansas Oil and Gas Commission issued a daily oil allowable for April, setting 69,819 bbl. as the total for settled and controlled production. Satisfaction with current allowables was expressed by producers in the flush fields, with the exception of Magnolia, where increased markets prompted some producers to suggest a small increase in allowable. The field was granted a 150-bbl. increase to 20,000 bbl. daily. Application for a special permit to drill on a 40-acre tract in the McKamie field was denied Frankel et al. The field was placed on 160-acre spacing last month when it was determined that it was a gas field. Since that ruling, a well has shown evidence of oil production and the application was sought on the premise that the proposed test would produce oil. The commission will grant a permit for a test to be located 100 ft. from the center of a 160-acre tract. The 40-acre permit was asked for an offset test completed by another operator.

GOV. HOMER M. ADKINS, speaking before the state-wide hearing of the Arkansas Oil and Gas Commission, stressed the need for an outlet for sour gas produced in South Arkansas. With regard to this problem he stated, "Some contend that on account of its large sulfur content, this gas cannot be made commercial. Others, apparently equally well informed, contend that the extraction of this sulfur presents no serious engineering or financial problem. Most of these gas reserves produce distillate, which can be produced only in conjunction with large quantities of gas. The people of this state will not long endure a wasteful method of production, which saves only the distillate and utterly wastes the greater product, the gas. Nor will they be content to see this gas consumed in wasteful enterprises or the greater part thereof piped away to feed industrial furnaces in other states. A proper use for this gas must be quickly found, or arrangements must be made to return it to the reservoir, for the benefit of those who come after us, and who doubtless will have the wisdom to apply it to its proper use."

He placed the responsibility of finding a present suitable use for the gas upon producers. The address followed a closed morning session in which producers and industrialists discussed possible uses to which the gas could be put. Difference of opinion is expressed by industrialists and scientists regarding the feasibility of treating McKamie gas for possible sulfuric acid manufacture. The gas contains 4,500 grains of sulfur per 100 cu. ft. and volume percentages averaging 5.4 carbon dioxide and 7.1 hydrogen sulfide.

CALIFORNIA

AFTER 2 HOURS of discussion the Conservation Committee of California Oil Producers at its regular current monthly meeting postponed action on a plan to increase heavy-crude-oil production for another month. The discussion was brought to a head by L. P. St. Clair, administrator for the committee, who pointed out that some plan for increasing production of heavy crude oil should be worked out, but that none of the methods suggested thus far accomplished the objective. Pursuant to instructions given at last month's meeting, the allocation committee made a study of seven plans, but found all of them increased production of light, gasoline-bearing crude oil along with that of heavy crude, while the need is only for the latter. The committee knocked off 1 bbl. from the top maximum bringing the highest maximum down from 145 bbl. daily to 144 bbl. per day. The state quota for the month of April was set at not to exceed 571,500 bbl. per day. Allotment for new and recompleted wells is estimated at 9,845 bbl. daily with decline from old wells, abandonments, and suspensions estimated at 6,072 bbl. per day, leaving a net increase of 3,773 bbl. daily. This increase will be partially absorbed by the reduction in top allotments of 1 bbl. per day which affects 1,004 wells.

NEW YORK

MEMBERSHIP IN THE OIL COMPACT is provided in a bill introduced at Albany, N. Y., last week. The measure would not become effective until Pennsylvania enacts a similar law. Sponsors of the bill are Assemblymen Harold C. Ostertag, Wyoming County, and Sen. James J. Crawford, Kings County. The bill follows the pattern of compact measures in other states in designating the governor as the official representative.

TEXAS

THE TEXAS RAILROAD COMMISSION would be prevented from prorating production in interstate fields below the neighboring state's allowable in a bill introduced last week by Rep. J. K. Hileman of Atlanta, Tex.

FINAL HOUSE APPROVAL has been given the McNamara bill permanently extending the state's proration laws. As sent to the senate, the bill reenacts the present law, but leaves out the expiration date, fixed by previous legislatures at 2 years.

TEN BILLS exerting direct effect on the Texas petroleum industry are pending action by the legislature. The bills are:

Three to place recycling operations under regulation of the Railroad Commission. Subcommittees are now considering the measures.

Increasing the oil production tax from 2¾ to 4½ cents per barrel.

Proposed new oil and gas conservation commission to replace the Railroad Commission in administration of regulatory laws and rules. The house killed this bill by voting to remove enacting clause.

Providing a graduated regulation for marginal wells, a bill now in committee.

Making the oil-conservation statute permanent. The house has passed the bill and it is now pending action by the senate.

Continuing membership of Texas in the interstate oil compact. The measure has been enacted by both houses.

Increase of the franchise tax, including income as a factor.

Stream-pollution bill, recommitted after protests.

The hike in oil-production taxes, as carried in the house omnibus bill, will draw $16,000,000 additional from the oil industry. Hearings on this measure opened Wednesday before the senate state-affairs committee.

WANTS GAS MARKET . . .

GOV. HOMER ADKINS of Arkansas last week committed his administration to finding new markets and outlets for sour-gas production in the southern part of the state. He spoke at Magnolia, Ark., before a meeting of producers and state officials called by the Conservation Commission

LOUISIANA

DAILY PRODUCTION of 300,893 bbl. in April was authorized last week by the state Conservation Board. The new allowable for next month represents a decline of 5,297 bbl. in daily average from the March schedule. The allowable production for South Louisiana was fixed at 233,191 bbl. compared to 236,722 bbl. daily in March. North Louisiana fields were allotted 67,702 bbl. compared to 69,468 bbl.

GOV. SAM H. JONES is considering the matter of making Louisiana a member of the interstate oil compact. A conference between Governor Jones and a group of Louisiana producers was held last week after which the chief executive said he was considering signing an order authorizing him to join the compact. Only the governor's signature is necessary to make Louisiana a member.

KANSAS

SPECIAL CONSIDERATION will be given to a proposed rule that would permit use of a packer for producing from two horizons in the same well at a meeting of the Corporation Commission at the Allis Hotel, Wichita, Kans., March 28. The broader question of whether general rules and regulations on production should be amended in any way will be considered at the same meeting.

MARKET DEMAND for Kansas crude oil in April has been estimated at 200,700 bbl. daily, Theo A. Morgan, conservation director, announced March 20. The April estimate is 6,500 bbl. above the March quota calculated by the Bureau of Mines and is 700 bbl. higher than the previous all-time peak of 200,000 bbl. in August 1937.

GEORGIA

A BILL HAS BEEN INTRODUCED into the Georgia Legislature placing control of all oil and gas operations under the governor and the Georgia Geological Department. This bill provides for issuing drilling permits, inspection of operations and proration of any future production of oil or gas.

NEW MEXICO

A MEASURE EXTENDING for 2 years New Mexico's participation in the interstate oil compact was passed March 17 by the senate and sent to the house.

The OIL AND GAS JOURNAL

PRODUCING REFINING NATURAL GASOLINE PIPE LINE

Published weekly by The Petroleum Publishing Company at Tulsa, Oklahoma

Frozen Economy

The open season for reports is under way at Washington and three, since the first of the month, have given petroleum and natural gas the headlines.

First came the observations of an economist of the Antitrust Division of the Department of Justice. He found nothing wrong with the oil industry's accomplishments but he doesn't like its manner of doing things. He wants public-utility control of its operations.

Then the president transmitted to Congress a report of the National Resources Planning Board which reiterates and elaborates on its previously known position that federal control of the oil and natural-gas industries is an essential part of its nation-wide economic planning.

The first of this week, the Federal Power Commission, not to be outdone, asked for greater control of the operations of the natural-gas industry. The commission says that before authorizing the construction of new lines it should have the power to consider the effects they might have on other fuels. This power to tell a housewife or manufacturer what fuel they must use, if granted, is without precedent in this country.

The ground covered in these reports is familiar and they are of interest only as they reveal that even a national emergency cannot stop these planners in their program of making over this country's economy with control centering in Washington. They apparently feel, in fact, that the present exigencies may offer a particularly opportune time for the opening wedge in their projects.

As one studies these reports, there is a certain similarity in the reasoning from which the conclusions are drawn. They find little fault with conditions as they are now. Profits are modest, labor conditions are far above the average and consumers get better products at low prices.

But they are fearful about the future. This thing, they insist, can't go on forever. They think they see a red light several blocks away and they want to come to a stop and start on an unknown detour, not being willing to continue on the main road until the signal clears.

They are concerned about waste and an early exhaustion of raw-material supplies. They say little about the workings of a competitive system fostering technological progress with savings in production many times greater than any waste. They analyze reserves on a basis of what is known today. They know, or should know, that as the necessity arose this industry devised means to find more oil and to produce it efficiently.

Suppose the economic theorists had arrived at the nation's capital 25 years ago and started coordinating this industry's future into a general scheme for a balanced economy. Not even a government expert could have foreseen what has taken place over a small part of the past quarter century.

In their projections they would have been forced to throw petroleum out the window as a factor in the general economy after 10 years. They would not have realized that the art of cracking would more than double the yields of gasoline from crude oil. They would not have considered the possibilities of crude oil below 6,000 ft. because no one then could drill that deep.

Fortunately, the arrival of these seekers of Elysium was delayed. Their appraisal of the future of other basic industries would have been as wrong as it would have been in the case of petroleum. The attainments of this generation emanating from industrial progress would not have materialized.

Studies which seek to coordinate the work of individual enterprise through the voluntary cooperation of operating units are to be commended. Those which aim to superimpose an all-powerful governmental control as a solution to minor ills, if they succeed, will not balance our economy, they will freeze it.

Balanced Program Promises Record A.A.P.G. Attendance

HOUSTON, Tex., Mar. 25.—A program that includes discussions of the most timely questions confronting the petroleum industry along with a well-balanced technical review assure record attendance at the annual meeting of the American Association of Petroleum Geologists here March 31 through April 5. Three field trips, committee meetings, technical and general sessions, exhibits, and a diversified entertainment program have been arranged. Alexander Deussen, general chairman and Perry Olcott, chairman of the program committee, have attempted to provide sufficient diversity in the arrangements to attract all elements in the profession.

Meeting jointly with the A.A.P.G. will be the Society of Economic Paleontologists and Mineralogists and the Society of Exploration Geophysicists.

Presidential and general addresses and the papers scheduled for presentation are listed below.

Presidential addresses.

A.A.P.G., L. C. Snider, department of geology, University of Texas, "Petroleum Geologists in the National Defense Program."

S.E.G., W. T. Born, Geophysical Research Corp., Tulsa, "The Future of Geophysics."

S.E.P.M., Carey Croneis, Walker Museum of Paleontology, University of Chicago, "Micropaleontology Past and Future."

Special addresses.

Robert E. Wilson, president, Pan American Petroleum & Transport Co. and in charge of Petroleum Section, Raw Materials Division, Advisory Commission to the Office of Production Management, "Petroleum and the War."

Papers to be presented.

J. Edgar Pew, vice president, Sun Oil Co., Philadelphia, Pa., "Fifth Dimension in the Oil Industry."

N. C. McGowen, president of United Pipe Line Co. and Union Producing Co., Shreveport, La. No title.

O. L. BRACE—Review of Developments in 1940, Gulf Coast and Upper Texas and Louisiana.

URBAN B. HUGHES—Developments in Mississippi in 1940.

TOM McGLOTHLIN—Notes on the Geology of Mississippi.

CARL B. RICHARDSON—A Comparative Study of the Origin and Distribution of the Gulf Coast Tertiary Sediments.

C. B. ROACH—A Subsurface Study of the Jennings Dome, Acadia Parish, Louisiana.

MICHEL T. HALBOUTY—Oil and Gas Stratigraphic Reservoirs in the University Oil Field, East Baton Rouge Parish, Louisiana.

DOROTHY A. JUNG and DORIS S. MALKIN—Marine Sedimentation and Oil Accumulation on the Gulf Coast.

CLARENCE E. BREHM—The Pickens Pool, Yazoo County, Mississippi.

S. RUSSELL CASEY and RALPH B. CANTRELL—The Davis Sand Lens, Hardin Field, Liberty County, Texas.

JOSEPH M. WILSON—The Geology of the South Cotton Lake Field, Liberty County, Texas.

PHIL F. MARTYN and CHARLES H. SAMPLE—Oligocene Stratigraphy of the East White Point Field, San Patricio County, Texas.

H. B. STENZEL—Sedimentary Cycles in the Eocene of the Texas Gulf Coastal Plain.

TAYLOR COLE, ROBERT I. DICKEY, and EDGAR KRAUS—Developments in West Texas and Southeastern New Mexico.

W. T. SCHNEIDER — Geology of the Wasson Field, Gaines and Yoakum Counties, Texas.

W. M. OSBORN—The Stratigraphic Trap of the Slaughter Field of West Texas.

W. A. WALDSCHMIDT—Progress Report on Microscopic Examination of Permian Crude.

TAYLOR COLE—Subsurface Study of the Ellenburger Formation in West Texas.

L. W. STORM—Resume of Current Opinion on Larger Features of Sedimentation in the Gulf Coast Region of Texas and Louisiana.

BASIL B. ZAVOICO — Foreign Developments During 1939 and 1940.

H. D. WILDE—Why Crudes Differ in Value.

P. E. FITZGERALD, J. R. JAMES, and RAY AUSTIN—Laboratory and Field Observations of the Effect of Acidizing Oil Reservoirs Composed of Sand.

C. E. DOBBIN—Developments in Rocky Mountain Region in 1940.

HARRY OBORNE—Paleozoic Correlation Between the Rocky Mountain Front Range and the Texas-Oklahoma Panhandle.

W. A. WALDSCHMIDT—Results of Petrographic Studies of Sandstone Cores From Rocky Mountain Structures.

W. C. TOEPELMAN—Microfaunas of the Niobrara and Benton in the Foothills of Northern Colorado.

H. F. SMILEY—New Developments in North and West Central Texas, 1940.

W. J. HILSEWECK—The Walnut Bend Pool of Cooke County, Texas.

H. N. FISK—The Midway-Wilcox Deltaic Mass.

J. O. BARRY—Correlation of Wilcox Faunal Units of Louisiana.

R. J. LeBLANC—Correlation of the Upper Midway Fauna of Louisiana.

GROVER MURRAY, JR.—Midway Stratigraphy of the Sabine Uplift.

ALFRED H. BELL—Oil and Gas Development in the Eastern Interior Basin in 1940.

PAUL H. PRICE and A. J. W. HEADLEE—The Geochemistry of Natural Gas in the Appalachian Province.

E. T. HECK — Gay-Spencer Richardson Oil and Gas Trend in West Virginia.

MAX W. BALL, T. J. WEAVER, and DOUGLAS S. BALL—Shoestring Sand Gas Fields of Michigan.

L. E. WORKMAN and I. T. SCHWADE—Subsurface Strata Between the Base of the Osage Group and the Top of the Devonian Limestone in Illinois.

JOSEPH PURZER and WARREN B. WEEKS—Development in Southern Arkansas and Northern Louisiana During 1940.

LEO HENDRICKS—Correlation of Subsurface Sections With Outcrops of the Ellenburger Formation of Texas.

JAMES L. CARLTON—Geology of Bartelso Oil Field, Clinton County, Illinois.

PARK J. JONES—Introduction to a Technique for Estimating Oil Reserves.

R. P. GRANT—Oil and Gas Developments in Michigan in 1940.

EDWARD A. KOESTER—Developments in North Mid-Continent in 1940.

LUTHER KENNEDY and others—Occurrence of Oil in Pennsylvanian Sand Stratigraphic Traps in Eastern Oklahoma and Southeastern Kansas.

EDWIN A. DAWSON—Eastern Oklahoma.

J. A. MULL—Stream Channels Applied to the Arbuckle of the Central Kansas Uplift.

EUGENE H. VALLAT — Brief Review of Exploration Work in California During 1940.

ROLLIN ECKIS — The Stevens Sand, Southern San Joaquin Valley, California.

E. W. GALLIHER and E. R. ATWILL—Methods of Stratigraphic Study Used in California.

R. W. SHERMAN—Del Valle Oil Field, Los Angeles County, California.

ALEX CLARK—Pre-Miocene Stratigraphy of Bakersfield Area, California.

A. F. WOODWARD—Recently Discovered Middle Miocene Production in the Inglewood Oil Field.

WILLIAM W. PORTER II and PAUL P. GOUDKOFF—Age of Shale in Amoura-Uscari Area, Costa Rica.

●

British American Opens Second Oil Field in Gulf of Mexico

HOUSTON, Tex., Mar. 25.—British American Oil Producing Co. 2-71 State, about 6 miles southwest of Sabine Pass and approximately 9,000 ft. out in the Gulf of Mexico, is flowing at the rate of 6 bbl. of pipeline oil per hour from perforated casing in the Miocene sand at 4,989-92 ft.

Tubing pressure is 640 lb. and casing pressure 420 lb. This is the third test to be drilled in the prospect and is the second oil field to be opened in the Gulf of Mexico.

California High-Gravity Crudes Reduced by Union

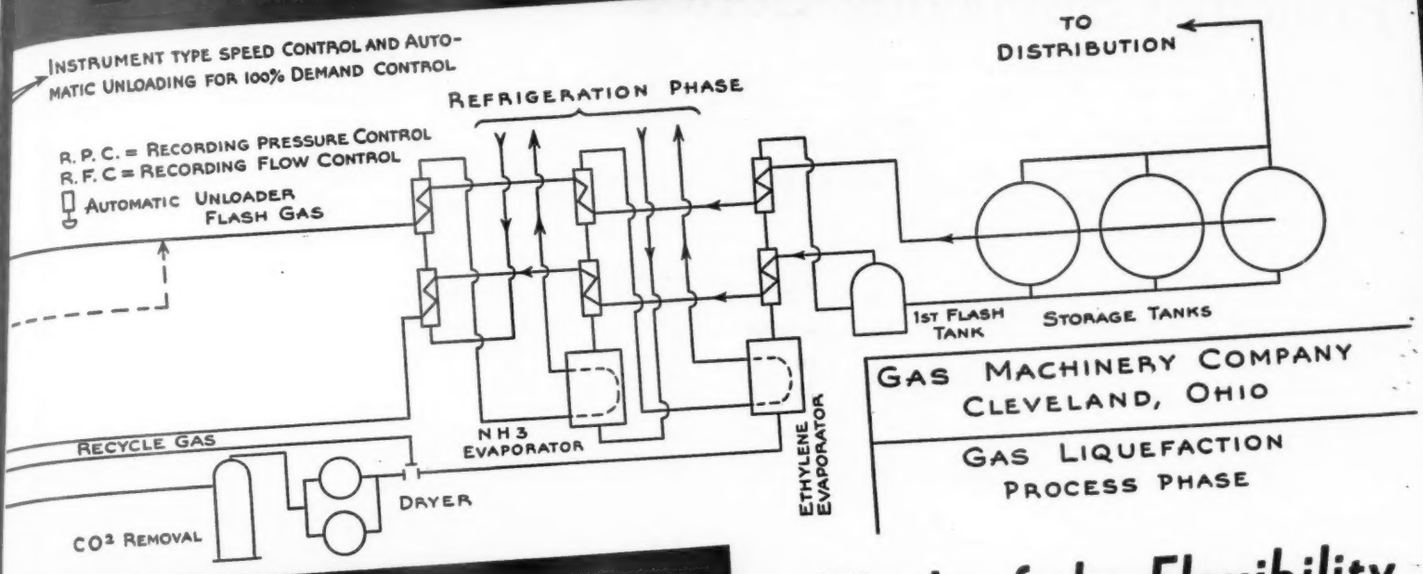
Union Oil Co., effective March 22, announced a new schedule of crude-oil prices for the California fields in which it purchases. The changes in most cases involve advances in grades below 26 gravity and reductions in grades above 26 gravity. The following table gives the new Union and Standard of California prices for Signal Hill crude oil:

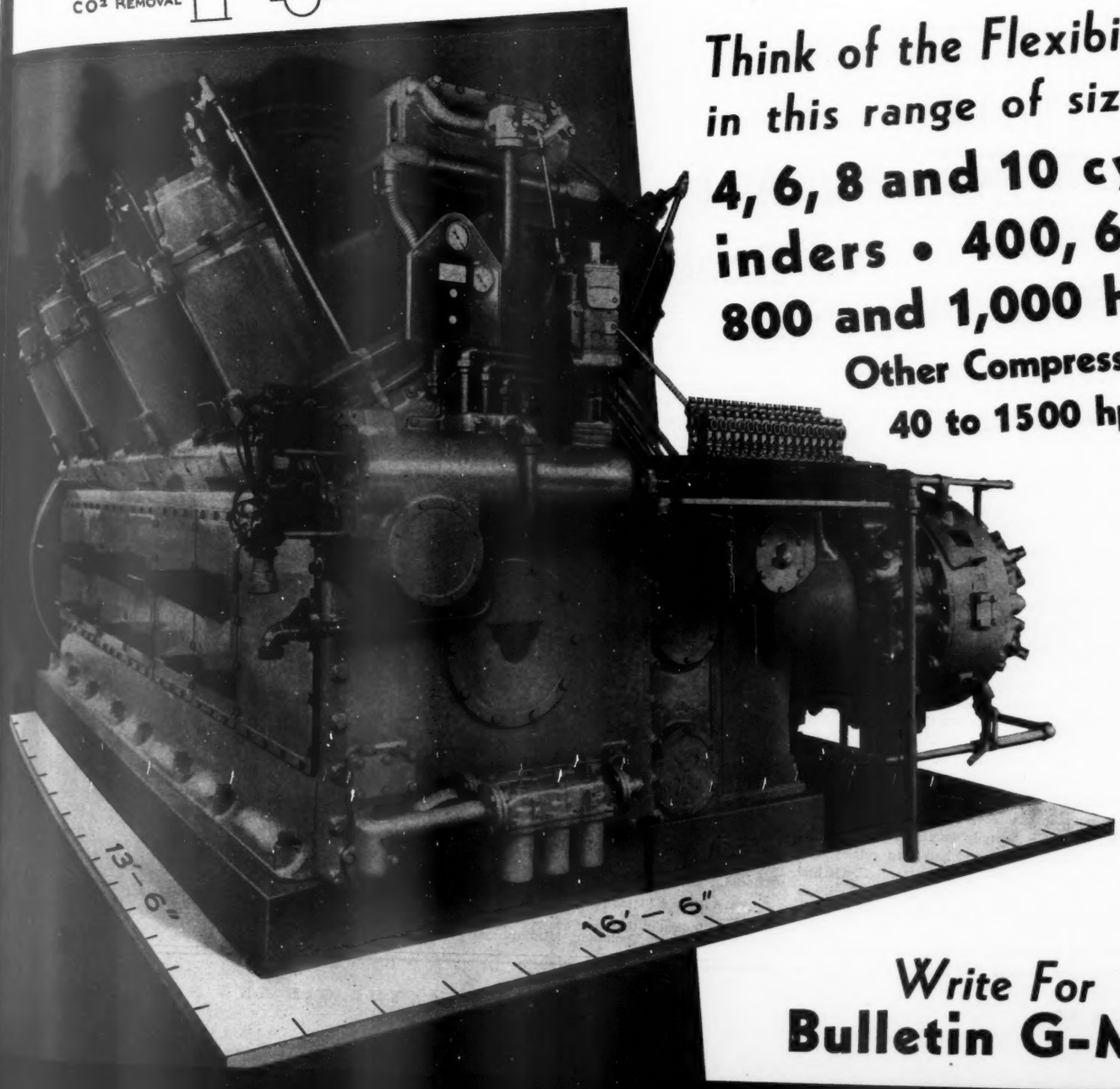
Gravity—	Union	Standard
14.5	$0.70	$0.65
15.5	.72	.65
16.5	.74	.65
17.5	.76	.65
18.5	.78	.65
19.5	.80	.69
20.5	.82	.73
21.5	.84	.78
22.5	.87	.82
23.5	.90	.86
24.5	.93	.90
25.5	.96	.95
26.5	.99	.99
27.5	1.02	1.03
28.5	1.04	1.07
29.5	1.06	1.10
30.5	1.08	1.14

ILLINOIS INDEPENDENT OIL PRODUCERS GROUP ELECTS OFFICERS

Top row, left to right: C. J. Haas, director and retiring secretary-treasurer; J. A. Matthews, secretary-treasurer; G. H. Blankenship, director and retiring first vice president. Front row, left to right: Barron Kidd, vice president, Harold S. Williams, president; J. D. Sanford, vice president; J. H. Steinmesch, first vice president, and S. Alden Perrine, vice president. Tyler L. Andrews, vice president, was not present for the picture

Flexibility!





Think of the Flexibility in this range of sizes:-

4, 6, 8 and 10 cylinders • 400, 600, 800 and 1,000 hp.

Other Compressors 40 to 1500 hp.

Write For
Bulletin G-MV

Crude Deliveries Increase From Principal Supplying States

AN increase of 882,000 bbl. in the interstate shipment of crude oil from New Mexico in January, an advance of 33 per cent over runs in December 1940, is the most significant change shown in the regular distribution report by the Bureau of Mines.

For the country as a whole, there was an increase of 1,670,000 bbl. in the interstate distribution of crude oil, an advance of 54,000 bbl. in the daily average, in January over the preceding month and a gain of 94,000 bbl. over the same month a year ago.

Shipments of oil were higher from all the principal states, those from Illinois and New Mexico showing the largest gains. New Mexico's shipments of 3,544,000 bbl. for January were the highest reported from that state since December 1939.

The gain of 175,000 bbl. in total shipments for January from Louisiana established a new high mark for crude distribution from that state.

Texas is the only large supplying state to suffer a decline in January compared to a year ago. January shipments from Louisiana were 1,209,000 bbl. higher, Kansas' runs were up 802,000 bbl., New Mexico 499,000 bbl., Oklahoma 219,000 bbl., others 746,000 bbl., and Texas was down 803,000 bbl.

The substantial increase of 882,000 bbl. in shipments from New Mexico was accounted for by higher runs to Texas, New Jersey, Massachusetts, and Maryland. In December 1940, there were no deliveries reported from New Mexico to Massachusetts and Maryland. Those two states received 104,000 bbl. in January while runs to Texas increased 636,000 bbl., and those to New Jersey advanced 146,000 bbl.

INTERSTATE CRUDE-OIL SHIPMENTS
(Thousands of barrels)

	Jan., 1941	Jan., 1940	Dec., 1940	Change Jan. 1, 1941, from Dec. 1940
Illinois	6,354	6,134	5,702	+652
Kansas	2,739	1,937	2,713	+26
Louisiana	5,494	4,285	5,319	+175
New Mexico	3,544	3,045	2,662	+882
Oklahoma	7,999	7,780	7,995	+4
Texas	12,064	12,867	11,731	+333
Other	4,105	3,359	4,507	—402
Total	42,299	39,407	40,629	+1,670
Daily av.	1,365	1,271	1,311	+54

DEATHS

H. H. JONES, 79, Houston, Tex., yard foreman for many years at the Baytown, Tex., refinery of Humble Oil & Refining Co., died March 20. Survivors include six daughters, four sons and a brother.

KAY C. KRICK, 71, general contracting agent for Ohio Fuel Gas Co., died March 19 at Columbus, Ohio. He was a former vice president and director of Logan Gas Co., Preston Oil Co., and Ohio Fuel Gas Co.

JOHN ELLIS, 43, of Portville, N. Y., employed as a pumper by the Messer Oil Co., dropped dead while at work on the Coon Hollow lease of the company on March 18. He leaves his widow and one son.

JOHN T. MUSGROVE, 31, toolpusher in Kansas for Helmerich & Payne, Inc., Tulsa drilling contracting and producing firm, was killed March 22 when his privately owned plane crashed and burned 10 miles southeast of Russell, Kans. Mr. Musgrove previously lived in Oklahoma City, Okla. His widow survives.

N. G. MOORE, general superintendent of the Pan American Pipe Line Co., Houston, Tex., died at his home Wednesday night from a heart attack. Before joining the Pan American Pipe Line Co. in September 1940, Mr. Moore was associated with the Cities Service Oil Co. in the Oklahoma City field, and was later transferred to the East Texas field as superintendent of the Empire Pipe Line Co., a subsidiary of the Cities Service. Burial was at his home, Mooresville, N. C.

LEROY KISLER, 48, a former employe of Mid-Continent Petroleum Corp., Tulsa, died of a heart ailment March 22. Mr. Kisler recently terminated 22 years of service with Mid-Continent and had been employed in the navy shipbuilding yard at Charleston, S. C. He had returned to Tulsa for a visit when stricken. Survivors are the widow, a son and two daughters.

ADOLPH A. BUSCHOW, 61, president and treasurer of the Bridgeport Machine Co., Wichita, Kans., and an independent producer, died March 17 from complications following an emergency operation. Mr. Buschow had been general manager of the Bridgeport company since 1922 and became president and treasurer in 1931. Earlier, he had been a managing officer in banks at Rexford and Augusta, Kans., and at Fort Collins, Colo. Survivors are his mother, widow, a daughter, two brothers, and two sisters.

ROGER W. SAWYER, 45, Chickasha, Okla., geologist, was killed in an accident March 17 at Roswell, N. M.

THE MARKETS*

CRUDE OIL: Sharp downward revisions in California crude-oil prices were imposed March 25 by Union Oil Co. of California based on the value of products recovered in refining. The reduction there followed a series of increases in stocks which are partially the result of curtailed sales to Japan. Elsewhere crude prices are firm and strong.

REFINERY: Gasoline prices are improving at practically all refining centers east of the Rocky Mountains. Mid-Continent suppliers advanced the low side of the motor-fuel market ½ cent last week and Gulf Coast operators are holding recent gains without difficulty. The Gulf market is showing evidence of again moving forward. East Coast gasoline prices have moved up in sympathy with higher costs at the primary source of supply.

TANK-WAGON AND POSTED-DEALER: Movement in this market is reported from scattered areas where impact of the buying generated by mild weather and the defense program is registered most strongly. Scattered reductions at points in Oklahoma and Tennessee are the results of local conditions.

FINANCIAL: Oil securities inched into higher ground last week. Average of 30 representative stocks for the week ended March 22: High, 22.87; low, 22.21; close, 22.72. Week ended March 15: High, 22.74; low, 22.05; close, 22.45.

*Detailed information in market section.

A. P. I. Raises Estimate on Reserves Half Billion Barrels

NEW YORK, Mar. 24.—An estimated increase during 1940 of more than a half billion barrels in the proved petroleum reserves of the United States, lifting the January 1, 1941, total to a new high of 19,024,515,000 bbl., was reported today by the American Petroleum Institute's committee on petroleum reserves.

The committee ascribed the increase of 541,503,000 bbl. over the 18,483,012,000-bbl. estimate of January 1, 1940, to discovery and development by the petroleum industry of 1,893,350,000 bbl. of new reserves as compared with 1940 production of 1,351,847,000 bbl.

The new total was said to include all grades of crude oil and distillate known to be recoverable under existing economic and operating conditions, but does not include reserves which may be found in favorable areas as yet untested. Explaining that the estimates refer only to reserves actually proved by drilling, the report said that pools tested by one or two wells have been assigned low reserves which may be considerably augmented by later development, a source of new oil regarded as equally important as the original discovery of the field.

ESTIMATED PROVEN PETROLEUM RESERVES IN THE UNITED STATES
(Barrels of 42 gal.)

State—	Proved reserves as of Jan. 1, 1940 (1)	Proved reserves discovered and developed in 1940 (2)	Production during 1940 (B. of M. preliminary) (3)	Proved reserves as of Jan. 1, 1941 (Col. 1 + 2 less 3) (4)
Arkansas	320,148,000	11,653,000	25,583,000	306,218,000
California	3,532,342,000	*17,079,000	223,881,000	3,291,382,000
Colorado	20,162,000	4,411,000	1,350,000	23,223,000
Illinois	381,636,000	80,457,000	146,788,000	315,305,000
Indiana	14,164,000	4,382,000	4,843,000	13,703,000
Kansas	725,467,000	32,891,000	66,270,000	692,088,000
Kentucky	44,086,000	2,106,000	5,193,000	40,999,000
Louisiana	1,173,225,000	146,195,000	103,961,000	1,215,459,000
Michigan	51,078,000	3,265,000	19,764,000	34,579,000
Mississippi	6,642,000	37,980,000	4,380,000	40,242,000
Montana	93,460,000	2,751,000	6,768,000	89,443,000
Nebraska	50,000	3,950,000	251,000	3,749,000
New Mexico	687,168,000	43,974,000	39,001,000	692,141,000
New York	35,392,000	34,608,000	4,999,000	65,001,000
Ohio	31,692,000	1,761,000	3,169,000	30,284,000
Oklahoma	1,063,152,000	94,709,000	155,952,000	1,001,909,000
Pennsylvania	183,123,000	21,877,000	17,353,000	187,647,000
Texas	9,768,371,000	1,348,271,000	493,126,000	10,623,516,000
West Virginia	45,888,000	10,000,000	3,444,000	52,444,000
Wyoming	305,616,000	24,888,000	25,683,000	304,821,000
Miscellaneous†	150,000	300,000	88,000	362,000
Total United States	18,483,012,000	1,893,350,000	1,351,847,000	19,024,515,000

*This indicates that new reserves discovered and revisions of previous estimates result in a negative net amount. †Includes Tennessee, Missouri and Utah.

More Dubbscracking needed

Some gasoline sellers who recently were nervous and trying to sell quantities of material, now give evidence of nervousness over the question of adequacy of their stocks to meet their needs—
CHICAGO JOURNAL OF COMMERCE, March 6, 1941

Only half that statement applies to Dubbs refiners

Dubbs refiners don't get "nervous" about finding buyers—they don't have to

But their stocks are never "adequate to meet their needs"

Dubbs refiners run their cracking units for all they are worth and still there is never enough Dubbscracked gasoline to go around

That's why so many are increasing their Dubbscracking capacity

How about you?

Universal Oil Products Co
Chicago, Illinois

Dubbs Cracking Process
Owner and Licensor

Bureau Sees 10 Per Cent Increase for Gasoline

DOMESTIC motor-fuel demand in April has been estimated by the Bureau of Mines at 52,500,000 bbl., an increase of 10 per cent over the same month a year ago and it is calculated that crude requirements will be 3,709,300 bbl. daily, an advance of 2 per cent over the actual for April 1940.

Increased demand for defense training and resumption of vacation travel are the two chief factors in the forecast of higher gasoline requirements. Exports of gasoline are estimated at 1,900,000 bbl., compared to 2,075,000 bbl. a year ago. April crude exports will total around 2,500,000 bbl., against 4,262,000 bbl. for the same month last year.

The trend for domestic crude oil in the first quarter of this year approximated the bureau's forecast, declares the monthly report issued last week. This was in spite of the fact that exports have been materially below expectation and runs to stills have been greater. A strong domestic demand for motor fuel has absorbed part of the "excess" seasonal production, the bureau said.

"The supply of heating oils," continues the report, "has proved more than adequate and imports of fuel oil continued on a high level." On the whole, the bureau said a better balance in the relative demand for the various products seemed probable, accompanied by a more normal refinery yield.

The following table shows by states the estimated demand for crude oil for April and March of this year, compared with actual demand in April last year:

(Figures in barrels daily)

State—	April	March	Apr. 1940
Texas	1,355,300	1,327,400	1,486,100
California	596,300	596,400	613,400
Oklahoma	429,300	437,400	439,000
Illinois	336,000	335,200	430,400
Louisiana	299,700	291,300	294,900
Kansas	200,700	194,200	160,500
New Mexico	109,000	103,900	109,400
Wyoming	88,900	83,900	62,100
Arkansas	75,700	69,700	70,500
Pennsylvania	49,000	48,100	52,700
Michigan	44,000	47,700	60,600
Indiana	23,700	22,600	10,100
Montana	21,300	21,900	17,700
Mississippi	20,300	20,300	7,700
Kentucky	16,700	14,200	14,900
New York	14,000	13,000	14,800
West Virginia	11,000	11,100	10,000
Ohio	10,000	10,100	9,100
Colorado	4,300	3,900	4,100
Nebraska	4,300	3,200	.....
Others*	.....	.....	200
Total	3,709,300	3,665,500	3,868,200

*Others include Missouri, Nebraska, Tennessee and Utah.

Final Cole Hearings and T.N.E.C. Report Promise To Clear Federal Policy

WASHINGTON, D. C., Mar. 25. — Federal policies toward the oil industry are expected to come to a head soon as the Cole committee proceeds with its final set of hearings this week and the T.N.E.C. is scheduled to file its final report April 3.

Indications are that the T.N.E.C. report will be relatively brief and general, without many specific proposals for dealing with individual industries. Still, it is known that advocates of federal control of the oil industry and of divorcement legislation are urging T.N.E.C. to adopt their proposals. Expectation is that Chairman O'Mahoney will recommend his scheme for federal incorporation of all interstate business as basis for control and that the report will call attention to an unsatisfactory situation in oil marketing.

The Cole committee will hold parts of its hearings in executive session to obtain views of officials on defense, and the bulk of open hearings are expected to deal with obstacles to pipe-line construction. The committee's report is due May 1, and its recommendations will probably be the key to House action on oil legislation.

Meanwhile the Senate judiciary committee has appointed a subcommittee headed by Senator Chandler of Kentucky to hear the Gillette divorcement bills, though hearings will not start before late April and after the T.N.E.C. report is filed.

As yet, there is no congressional reaction to the control proposals of the Resources Planning Board and none is expected until some administration supporter introduces legislation and it is taken up by a committee.

Government Gasoline Purchases on Increase

WASHINGTON, D. C., Mar. 24.—Gasoline purchases under Procurement Division contracts will show a tremendous increase in the 1942 fiscal year—possibly doubling quantities bought in previous years, according to estimates now being received.

Thus far, the division has reviewed estimates of requirements for the first quarter of the 1942 fiscal year approximating 60,500,000 gal. (1,440,500 bbl.). These estimates daily are being revised upward. In the like quarter of the present fiscal year requirements totaled 35,200,000 gal. (840,000 bbl.)

Nearly all the increase is a result of the national-defense program and is traceable to the additional needs of the military services.

The Procurement Division contracts for all gasoline and fuel oil used by the Army (except aviation gas and fuel oil obtained under Navy marine delivery contracts), by shore establishments of the Navy, and by all civilian agencies.

Approximately 150,000,000 gal. (3,600,000 bbl.), to be delivered to 8,000 points, have been estimated by federal agencies as their requirement for the full 1941 fiscal year. For the 1942 fiscal year, 24 Army posts alone estimate their requirements at 100,000,000 gal. (2,400,000 bbl.).

BULL WHEEL TAKES A RIDE . . .

BRADFORD, Pa.—Crew members on a drilling well in McKean County, Pennsylvania, could hardly believe their eyes when they saw the 1-ton bull wheel dangling from the drilling cable and crown block 57 ft. above their heads. The crew was lowering tools in the hole when the brake slipped off and the tools began to drop so fast they loosened the bull wheel from its bearings and then lifted it to the top of the derrick.

Export License Procedure Clarified by Giving More Power to Administrator

WASHINGTON, D. C., Mar. 24.—Changes put into effect last week in the administration of the export license Control Act form the predicate for using this law as an instrument of economic warfare against the Axis powers. Too, exporters may better understand operations of the control system and know exactly what commodities are subject to license.

Under two executive orders issued by the president on March 15, supplementing one dated March 4, much of the work of controlling exports has been delegated to the administrator of export control, who has greatly enlarged his staff and is now in new quarters in the Department of Commerce Building. Licenses for the export of commodities will continue to be issued by the Division of Controls of the Department of State and enforced by collectors of customs, but the administrator now has authority to issue regulations defining and describing the articles subject to license. In the past this has been done by executive order or by informal instructions to the collectors, with the result that exporters have had little opportunity to keep informed of the rapid changes. In the future all such regulations and lists of articles subject to license will be published in the Federal Register.

The first such list already has been published, being a recapitulation of all articles already subject to license or which will be under license by April 15. Designated "Export Control Schedule No. 1," the list gives exporters and customs collectors an easy reference for determining exactly what articles may not be exported without a license.

In addition to publishing Schedule No. 1 in the Federal Register of March 21, it is printed in a booklet on "Export Control Regulations," issued by the administrator. The booklet includes the texts of the export license control act, all proclamations issued under the act, and general instructions for exporters as to how to obtain and use licenses.

Railroad Commission May Continue Formula

AUSTIN, Tex., Mar. 25.—Testimony presented at the longest proration hearing on record here last week is under scrutiny by the Railroad Commission, which is preparing an April allowable schedule.

Indications are that the commission will continue its formula first tried in March, which caused only a few protests.

Suits instituted by operators in the Hamman and Old Ocean fields seeking to enjoin the commission from enforcing its March proration order have been answered by restoration of the previous schedule.

The premium placed on the low-cold and high-octane crudes is the main feature of the formula. In the low-cold-test-crude areas, Gulf Coast heavy crude, wells from 2,000 to 3,000 ft., are given 30 bbl., with 5 bbl. for each additional 1,000 ft. of depth. In the high-octane areas, above 60 octane, the base is 25 bbl. for wells of 2,000 to 3,000 ft., with 5 bbl. added for each 1,000 ft.

Both, as well as Mirando and low-octane crudes, are based on 10-acre spacing, with 1 bbl. to be added or subtracted for each acre variance from the pattern. For example, a well on 20 acres would be given 10 bbl. additional, while a well on 5-acre spacing would lose 5 bbl.

For the Mirando type crude, Southwest Texas heavy, wells below 1,500 ft. were given 15 bbl., with wells from 1,500 to 2,000 ft. 20 bbl. and 5 bbl. additional for each 1,000 ft.

Cut Ordered in Rail and Pipe-Line Rates for Transporting Gasoline

By HENRY D. RALPH

WASHINGTON, D. C., Mar. 24.—Gasoline tank-car rail rates and gasoline pipe-line rates from Mid-Continent refining points to distribution centers in the Middle West will be cut drastically under an order issued March 2 by the Interstate Commerce Commission in the case brought by the Petroleum Rail Shippers Association, Docket 28106.

The commission rejected the proposal that railroads be required to establish lower rates on train-load shipments of gasoline, as proposed by Examiner C. E. Stiles in a tentative report filed last April (The Oil and Gas Journal, May 2, 1940, p. 25) but it recommended that the railroads give consideration to establishing train-load rates voluntarily.

The new tank-car rates are not as low as those sought by the independent refiners, but they are far below present rates and are designed to bring back to the rails some of the traffic lost to trucks, pipe lines, and barges in recent years. The reductions are also intended to benefit independent refiners and jobbers in competing with integrated companies.

Pipe-Line Cuts Limited

The pipe-line rate reductions apply only to the gasoline lines of the Great Lakes Pipe Line Co. and the Phillips Petroleum Co. The commission compromised on the demand for a lower minimum tender by requiring the lines to permit independent refiners to accumulate products of the same specification until the minimum tender is reached.

This is the second time in recent months that the I.C.C. has ordered a reduction in pipe-line rates, and this order as to gasoline lines comes on the heels of an order, still not in effect, requiring crude-oil lines to reduce their rates to the basis of a uniform return on valuation. The gasoline order is not based on earnings but on the comparable rail-rate reductions. Gasoline pipe-line rates customarily have been the same as rail rates.

Independent refiners and jobbers see this case as a turning point in their struggle for lower rates.

The importance of the many issues in this case is shown by the fact that the commission's report is 10 pages in length and discusses the gasoline transportation situation in detail. It is also significant that of 11 commissioners, three dissented and four filed separate concurrences.

In addition to the general reductions, the I.C.C. ordered a readjustment of the rates to Illinois and Indiana, substantially as recommended by the examiner, leaving it to the railroads whether to raise the rate to Chicago or reduce the rate to Indianapolis.

On one other important point the commission sustained its examiner's proposal. This was the contention of the independent refiners belonging to the Petroleum Rail Shippers Association that the "commerce" over which the I.C.C. has jurisdiction is trade and industry in general, and that it is the duty of the commission to adjust transportation costs between competing sections of an industry. The I.C.C. adhered to its traditional policy of basing its decisions on transportation factors alone, regardless of other elements of competition among the users of the transportation services.

The commission found that independent refiners are rapidly losing their markets in the Middle West due to pipe lines, barge transportation, and new production in Illinois and Michigan, and that the gasoline traffic of the railroads is likewise falling.

The complainants asked that the tank-car rates be reduced to the 1916 level where they were at the time of the first I.C.C. decision on that subject in the Mid-Continent oil-rates case. They contended that since 1916 the entire competitive situation has changed and that various increases in rates have been expressed in percentages which have been a heavier burden on long hauls than on short, so that an entire revision of the rate structure is necessary.

Based on Group 3

The new rail rates, which are to go into effect on or before June 11, 1941, are expressed in rates from Group 3 origin points (generally speaking, refining centers in Oklahoma) to named destinations in what is known as western trunk-line territory and also some points in Indiana and Illinois. The order also requires the railroads to make comparable adjustments in rates from other Mid-Continent origins and to other destination points in the same regions.

The following table shows the 1916 rates which were sought by complainants, the 1928 rates, the 1938—and present—rates, and the new rates ordered by the I.C.C. from Tulsa, the representative point in Group 3, to key destination points used as the basis of the order (in cents per 100 lb.):

To—	Rates			Ordered by I.C.C. June 11
	1916	1928	1938	1941
Kansas City, Mo.	15	25.5	28	22
Jefferson City, Mo.	20	30	35	26
St. Joseph, Mo.	15	25.5	28	25
St. Louis, Mo.	20	30	33	29
Des Moines, Iowa	22.5	33	36	29
Cedar Rapids, Iowa	23.5	35.5	39	32
Fort Dodge, Iowa	27	36.5	40	32
Mason City, Iowa	28.5	38	42	34
Sioux City, Iowa	28	36	40	32
Keokuk, Iowa	21	33	36	31
Dubuque, Iowa	23.5	38	42	35
Omaha, Neb.	23	33	36	29
Lincoln, Neb.	23	33	36	28
Sioux Falls, S. D.	31	40	44	34
Peoria, Ill.	22.5	35.5	39	33
Chicago, Ill.	25	36	40	36
Milwaukee, Wis.	30	39.5	43	39
Wausau, Wis.	32	46	51	42
Madison, Wis.	30	42	46	37
Green Bay, Wis.	32	46	51	41
Rhinelander, Wis.	36	49	54	43
St. Paul, Minn.	31	42	46	37
Duluth, Minn.	36	47	52	41
St. Cloud, Minn.	36	47	52	39
Granite Falls, Minn.	31	42	46	36
Marquette, Mich.	42.5	57	63	47
Escanaba, Mich.	42	56.5	62	46

Exact comparison of the new pipe-line rates with the rail rates is difficult because of the limited number of origin and destination terminals of the pipe lines. Much of the testimony concerned the so-called proportional rates published by the pipe lines for movements over both pipe line and rail. The commission made the finding that the present local pipe-line rates, and in many instances the proportional rates, of the two pipe lines involved are unreasonable. It prescribed reasonable rates for the future, and stated that under the new pipe-line and rail rates there is no further need for pipe-line proportional rates and these must be canceled.

The order is not based directly on earnings of the pipe lines, as was done in the crude pipe-line rate case, but the I.C.C. used valuation figures of the two lines and made a rough approximation of their average cost of moving gasoline during the period from 1937 to July 1940 and added a return on value at 10 per cent. This total figure is considerably less than the new rates prescribed, so that presumably the gasoline pipe lines will continue to make a higher profit than the crude lines. The following table shows the new rates ordered by the I.C.C. and also the commission's findings of cost plus return on value:

Great Lakes P. L. Co. terminals— To:	Average haul Miles	Cost plus return on val. Cents	Rates ordered by I.C.C. Cents per bbl.	Rates ordered by I.C.C. Equiv. in cents/ 100 lb.
Kansas City, Mo.-Kans	189.44	9.12	28	10
Des Moines, Iowa	328.55	10.90	36	13
Omaha, Neb.	390.24	12.79	42	15
Coralville, Iowa	436.97	13.63	44	16
Minneapolis, Minn.	585.10	17.82	58	21
Chicago, Ill.	629.27	19.84	67	24
Phillips P. L. Co. terminals:* To:				
Kansas City, Mo.-Kans.	469.75	9.79	33	12
Jeff Station, Mo.	565.24	11.58	39	14
East St. Louis, Ill.	680.73	15.76	53	19

*Except Kansas City, Kans.

Gasoline rail rates from Oklahoma to Indiana were found by the I.C.C. to be out of line with rates to Illinois destinations, chiefly because of the method used by the railroads in grouping a number of points to take the same rate. As to this situation the I.C.C. said:

Indiana Adjustment Ordered

A special case of undue prejudice and preference is alleged as to rates to Indiana. At the Indiana-Illinois state line the rate difference on refined petroleum products is 6 cents, while the rate differences between Illinois groups are from 1 to 3 cents.

Using all points with a population of 5,000 or more, the Indiana Independent Petroleum Association, Inc., shows the average distance from Tulsa to each of the Illinois and Indiana groups, and the Group 3 rates. In the following table of such rates and distances the I.C.C. designated the groups by the name of one or more of the principal destinations in each.

COMPARISON OF GROUP DISTANCES AND RATES FROM GROUP 3

Group	No. of points used	Group distance from Tulsa (miles)	Rates from Group 3 (cents)
St. Louis, Ill.	7	437	33
Cairo-Keokuk, Ill.	8	474	36
Springfield, Ill.	19	522	39
Chicago, Ill.	31	595	40
Rockford, Ill.	10	632	42
Milwaukee, Wis.	12	710	43
Terre Haute, Ind.	15	606	46
Indianapolis, Ind.	13	686	48
Muncie, Ind.	15	715	51
Fort Wayne, Ind.	10	748	53
Auburn, Ind.-Cincinnati, Ohio	8	772	55

It is pointed out that the method of grouping is such that Chicago, the most important consuming point in Illinois, 678 miles from Tulsa, is

(Continued on Page 244)

ROTATING...WITH A WORLD OF SERVICE

EMSCO
TYPE "F" SWIVELS

For a world of service under severe operating conditions, the Emsco Type "F" Swivel gives new confidence in swivel safety and dependability.

Two radial bearings, mounted far apart, maintain accurate alignment and provide equal distribution of the load on the load bearing. This bearing is set low in the oil reservoir (capacity 18 gallons) so that in event of a low oil level the bearing will be protected.

Economical maintenance and repair has been given much attention. The wash pipe is both inexpensive and easy to replace. The sleeve is protected against direct wear with inner and outer protecting rings pressed on; these may be removed and replaced at small cost. The sleeve itself may be removed by simply lifting the top cover.

The swivel is rated for 11,000 ft. using 4½-in. drill pipe at 100 r.p.m. Actual field tests prove it to be the most trouble-proof yet developed. Information on this Type "F" or any other swivel from Emsco's complete line will be gladly furnished upon request.

THE CONTINENTAL SUPPLY COMPANY
General Offices: DALLAS, TEXAS
Foreign Sales Subsidiary
CONTINENTAL EMSCO COMPANY, Inc.
30 Rockefeller Plaza New York City, N. Y.
Representatives:
LONDON MARACAIBO BUENOS AIRES TRINIDAD

CONTINENTAL
SERVING THE OIL AND GAS INDUSTRIES

Miocene Development Looms In Inglewood Field, California

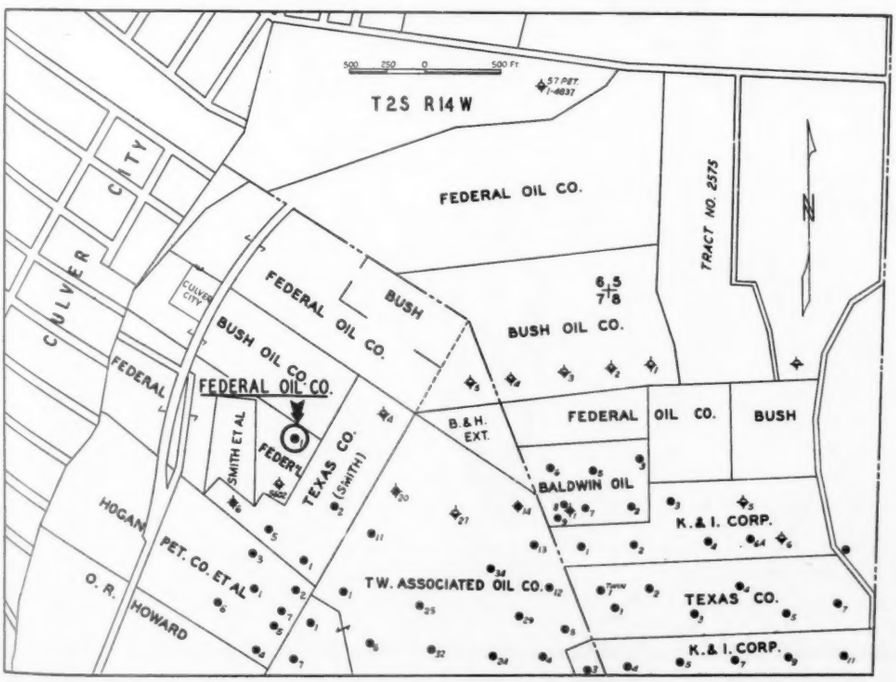
By L. P. STOCKMAN

LOS ANGELES, Mar. 25.—Miocene development in the Inglewood field of Los Angeles Basin is scheduled to get under full swing in the immediate future. This field is expected to be a factor of considerable importance from a production standpoint before the close of the current year.

Federal Oil Co.'s Miocene discovery was a projected deep-zone test far out on the north dip of the structure on the Smith property, but drilling was suspended at 7,765 ft. when a fishing job materialized. A short time later R. R. Bush took over operations and after cementing the fish in place deepened the hole to 8,334 ft. and completed it flowing 1,750 bbl. of clean 32.1-gravity oil and 2,500,000 cu. ft. of gas daily through a 58/64-in. bean. This well, due to lack of storage, was pinched back and has been averaging about 500 bbl. daily since completion on March 5, 1941. Pressures average 2,500 lb. on the tubing and 4,000 lb. on the casing, but since the fittings used on the well are substantially below these pressures, the company has found it advisable to keep bleeding off gas to relieve the high pressure against the casing. This well, it will be noted from the comparative depths, found top of the Miocene zone about 325 ft. higher structurally than 1 Sentous in the extreme southwestern end of the field. In 1 Smith, top of the oil sand was logged at 7,950 ft. and the 414-ft. interval open below the shoe of the 7-in. water string, which had been cemented at 7,920 ft., consists of 50 per cent oil sand. This means that 1 Smith, the northern outpost, has over 200 ft. of good oil sand.

Federal Oil Co. divided its acreage with Bush on a 50-50 basis in a checkerboard fashion. Federal's second well will be located on a portion of the Smith homestead which was held out of the original lease. R. R. Bush Oil Co. has started work on 1 Merchants and this well is expected to result in good production upon completion due to its proximity to 1 Smith, which is still flowing through a 9/64-in. bean. Texas Co. holds adjoining acreage and it is quite likely that this company, Tide Water Associated Oil Co., Hogan Petroleum Co. and other operators will begin early exploitation work. All operators holding productive and potentially productive acreage in the Inglewood field have been working on a program involving well spacing and the casing program that will be used. It appears probable that 20-acre staggered locations will be used as far as possible in areas where they can be used to advantage, but it is extremely doubtful that a program contemplating even one well to 10 acres can be used in the northern end of the field due to the relatively small blocks and large number of diversified interests involved.

The most interesting feature in connection with the impending development of the Miocene is the fact that the northern limits of production are still open and thus there is a possibility that the deep zone might extend over into the Culver City town-lot area. Federal's 1 Smith, deep-zone well, is located about 1,500 ft. from the easterly edge of subdivided acreage. This well was drilled in a canyon which slopes to the north and swings around to the east at its southern extremity and passes across the northern part of the Smith lease of Texas Co. This means that Texas will not have to do much road work to reach the location of its offset to 1 Smith. The starting of offset drilling by Texas Co. will make it necessary for Tide Water Associated Oil Co. to undertake immediate drilling, and when the latter starts it will mean the signal for Standard Oil Co., Baldwin Oil Co., Kettleman & Inglewood Corp., Shell Oil Co. and others to do likewise.



Northwest end of Inglewood field of Los Angeles Basin showing location of deep Miocene completion of Federal Oil Co. and proximity of Culver City town-lot section which may undergo exploration

On Topographic Feature

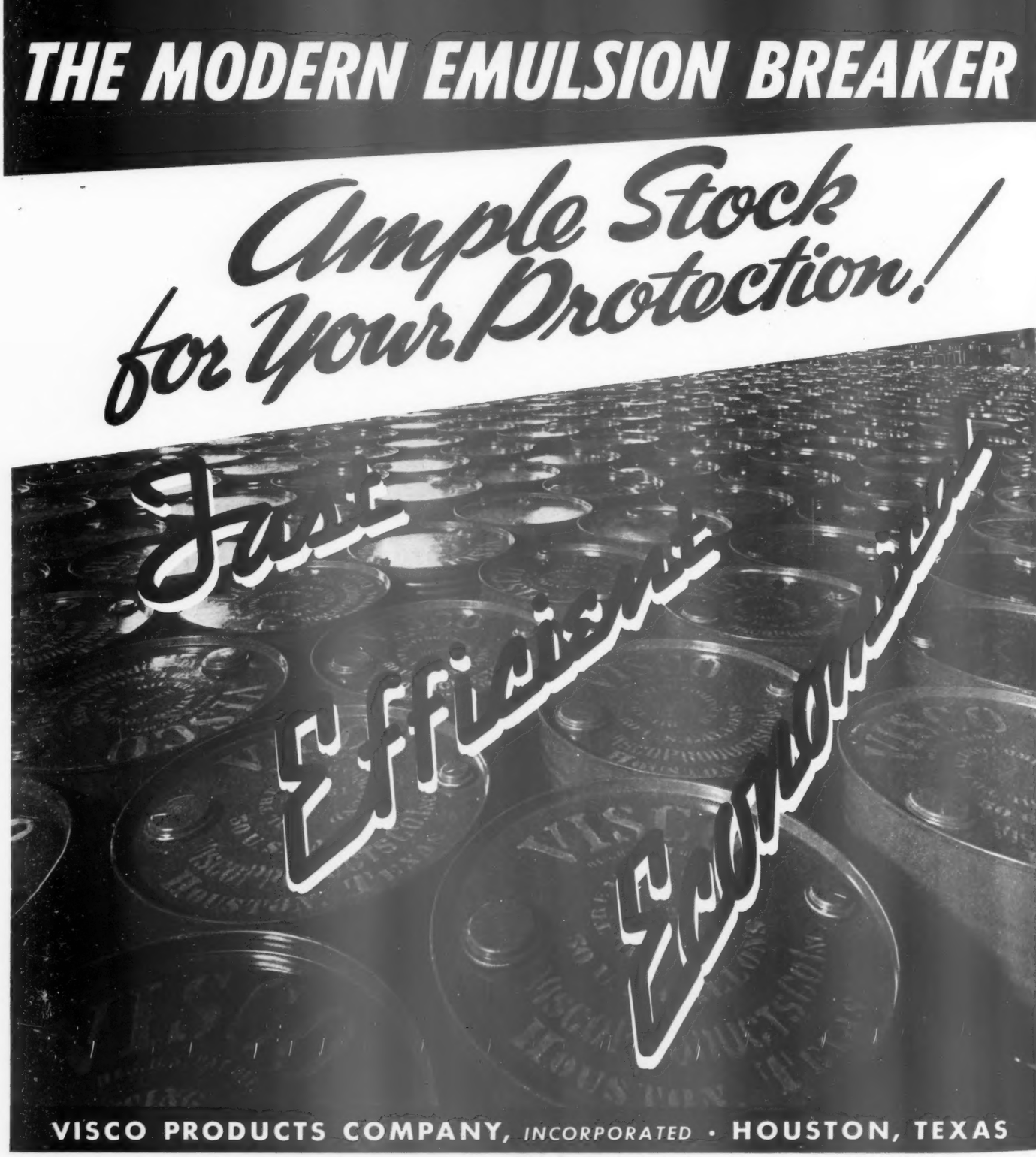
The Inglewood field lies in the Baldwin Hills about 3 miles northwest of the town of Inglewood and along the general line of folding that extends from Beverly Hills on the northwest to Newport at the extreme southeast, upon which are located the Inglewood, Potrero, Rosecrans, Dominguez, Long Beach, Seal Beach and Huntington Beach fields. Baldwin Hills is the most prominent topographic feature of the general uplift extending from Beverly Hills to Newport in the west side of Los Angeles Basin. Baldwin Hills forms a block, roughly rectangular in shape, with steep escarpments on the north and west sides, the east and south sides sloping gradually to the plain of Los Angeles Basin. They rise about 300 ft. above the surrounding plain and are cut by two deep erosion channels from northwest to southeast which reflect the strike of the Inglewood fault. The highest portion of the Baldwin Hills is east of this fault and commercial production in the Pliocene has been developed on both sides. The prominent escarpment on the north flank of the hills was originally thought to be a secondary fault, probably an offshoot of the main Inglewood fault, but drilling operations now show this was due to erosion of an old stream channel.

The upper oil measures occur in the upper Pliocene or Fernando formation and are stratigraphically higher than in other fields along this Beverly-Newport fold, but top of the Miocene is stratigraphically lower than in some of the other fields along this general fold. The Inglewood field represents an elongated dome approximately 2 miles long by approximately 3,600 ft. wide, with the axis striking northwest-southeast, cut by a fault along its east side, with a smaller fold east of the fault. This Inglewood fault has a throw of from 350 to 400 ft. and hades to the west. The major part of the field lying west of the fault is on the downthrow side. Contours on the east side of the fault increase in depth toward the northwest, beginning in the northern part of Section 17, whereas the contours west of the fault increase in depth to the southeast, beginning in the southern part of Section 8. This feature is probably indicative of a horizontal displacement along the fault in a southeast direction as well as a vertical displacement. Gravity of oil found in wells east of the fault is somewhat higher than the gravities found in the major part of the field. This, however, is only true of wells in the upper zones. Both of the Miocene producing wells, Federal 1 Smith and Bush 1 Sentous, are located far down on the Inglewood structure and for this reason this productive horizon should be found higher up in wells located nearer the apex of the structure.

VISCO

THE MODERN EMULSION BREAKER

Ample Stock for Your Protection!



VISCO PRODUCTS COMPANY, *INCORPORATED* · HOUSTON, TEXAS

NOTICE: Visco Products Company is authorized to manufacture and sell Visco Oil Treating Compounds for use in the breaking and resolving of oil emulsions under the following United States patents: 1,860,562; 1,880,563; 1,912,330; 1,937,259; 2,050,639; 2,050,640; 2,214,783; 2,214,784; 2,206,589; 2,225,189. Re. 20,717 & patents pending. Any purchaser of Visco oil treating compounds is authorized to use the same in the treating, breaking and resolving of oil emulsions in accordance with the above patents. Visco Products Company is authorized to and is willing to grant licenses to oil companies under any and all of the above patents on royalty bases, permitting the producer to purchase the oil treating compounds at will from any vendor, and to prepare the compounds for use under the above patent or patents. Application for license should be made to **Visco Products Co.**, Houston, Texas.

Refinery Expansion

Refinery to Be Built At Memphis, Tenn.

SHREVEPORT, La.—Plans for the construction of a $500,000 refinery near Memphis, Tenn., were announced by chamber of commerce officials of that city last week. The plant is to be built by the recently organized Delta Refining Co. and will operate partially on crude produced in the Tinsley field of Mississippi. Railroad trackage is being laid to the plant site and a terminal is to be constructed on the Mississippi River. The skimming plant is expected to be placed in operation by May 1, with plans calling for erection of a cracking unit during the next 6 months.

Three Rivers Refinery's Production Sold to Akin

Contract has been negotiated by Akin Gasoline Co., Tulsa, for the entire output of Three Rivers Refinery at Three Rivers, Tex. The plant produces Texas coastal lubricating oils, subzero distillate and asphalt. Improvements to plant facilities have been completed recently. Capacity is 2,000 to 2 500 bbl. daily.

Refiners Report Expenditures In Excess of $100,000,000

Establishments which accounted for 98.4 per cent of the value of products manufactured in the petroleum-refining industry reported total capital expenditures for plant and equipment for 1939 amounting to $111,535,112, according to preliminary figures compiled from the returns of the 1939 Census of Manufacturers taken in 1940, and released by Acting Director Vergil D. Reed, Bureau of Census, Department of Commerce. The remaining establishments, which accounted for 1.6 per cent of the total value of products of these industries, did not reoprt any expenditures for plant and equipment during 1939.

The Bureau of the Census obtained for the first time information on the expenditures for plant and equipment by manufacturing establishments. Such establishments were requested to report charges to capital account for new depreciable assets at cost value.

The major portion of these expenditures represented the cost of new construction amounting to $85,189,228, or 76.4 per cent of the total. The purchase of new machinery was valued at $23,257,202, or 20.9 per cent of the total, and of plant and equipment acquired in a "used" condition and expenditures for land, $2,773,728, or 2.5 per cent of the total.

The expenditures for plant and equipment shown in this table include only expenditures reported by establishments engaged in active production during the year 1939. They do not include expenditures by inactive establishments or new establishments whose plants were under construction during the year 1939 but were not completed and actually in use during the year 1939. Summary statistics for 1939 for the industry are shown in the following table.

	Number or amount	Per cent of industry total
Total number of establishments	485	100.0
Number of establishments reporting capital expenditures for plant and equipment	418	86.2
Total value of products	$2,461,126,549	100.0
Value of products of establishments reporting expenditures for plant and equipment	2,420,596,764	98.4
Total expenditures for plant and equipment	111,535,112	100.0
Expenditures for new construction or major alterations of buildings and other fixed plants and structures	85,189,228	76.4
Expenditures for new machinery and operating equipment	23,257,202	20.9
Expenditures for plant and equipment acquired in a "used' condition from other owners and expenditures for land	2,773,728	2.5
Expenditures, unclassified	314,954	0.3

Natural Gas

United Delivering Gas to Louisiana Army Camp

United Gas Pipe Line Co. recently began regular deliveries to a large army camp in the vicinity of Alexandria, La., where gas requirements are approximately the same as those of a city of 30,000 population. At the same time the Government and United conferred on gas requirements at other projected camps.

In a recent interview R. H. Hargrove, general manager of United Gas Pipe Line Co., said, "We are proud of the part this area and the natural-gas industry is now playing and in the fact that they are prepared to play an even greater part in meeting the demands of our national-defense program."

Iroquois Authorized To Absorb Gowanda

Iroquois Gas Corp. has been authorized to merge its wholly owned subsidiary, Gowanda Gas Corp., into the parent organization. Permission was granted by the Pennsylvania Public Service Commission after petition was presented before Maurice C. Burritt who found the proposal to be in the public interest.

Gowanda was a gas-producing and distributing concern, serving approximately 1,450 customers. The Iroquois company has gas wells and pipe lines adjacent to the territory served by Gowanda in Erie County, Pennsylvania.

Operations of Texas Panhandle Plant Revamped

AMARILLO, Tex.—Hagy, Harrington & Marsh (formerly Cargray) of Amarillo has revamped its natural-gasoline plant near Kings Mill, Tex., to enable it to abandon manufacture of 26-lb. natural gasoline. With the new setup, the plant is equipped to have the entire output consist of isopentane, isobutane, and a 9-lb. vapor-pressure product which will be blended into a finished motor fuel. The plant has a 50,000-gal. daily output of natural gasoline, based on a 26-lb. product, and 25,000 gal. liquefied-petroleum-gas capacity.

Natural Gasoline

Natural-Gasoline Yield Off Slightly in January

Natural-gasoline production in January totaled 4,884,000 bbl., according to the Bureau of Mines report issued last week. The daily average production of 158,000 bbl. compares with 160,000 bbl. for December 1940 and with 138,000 bbl. in January, last year. Major declines in January production were reported by the Texas Gulf Coast, the Panhandle and Louisiana.

Stocks of natural gasoline declined to 5,490,000 bbl. at the end of January, compared to 5,704,000 bbl. on December 31, 1940. Inventory on January 31, 1940, totaled 4,476,000 bbl.

Shipments to jobbers and retailers increased in January to 686,000 bbl., compared to 595,000 bbl. Exports in January fell to 61,000 bbl., against 160,000 bbl. in December.

Deliveries to refineries totaled 4,165,000 bbl., with an average vapor pressure of 21.1 lb.

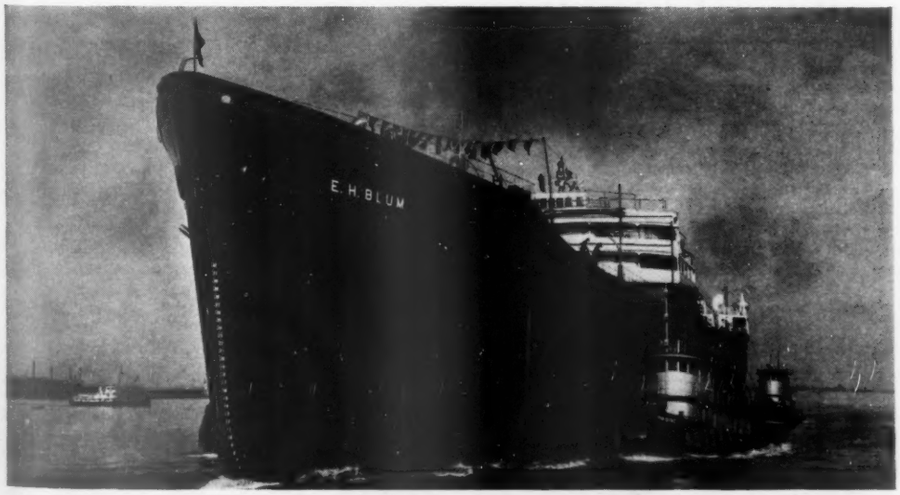
●

Magnolia Lays Lines In Archer County, Texas

Producing oil wells in the Hospital pool and Vogtsberger areas in North Archer County, Texas, will receive pipe-line facilities within the next 2 weeks.

Magnolia Pipe Line Co. announced the start of construction of a 4-in. welded line to the fields and will hook in to the main 8-in. line running from the Ringgold pool in Montague County to the Hull-Silk production north of Holliday. The line will traverse the territory to the Continental Oil Co., Petroleum Producers production in the section southeast of the Hospital and continue to the Gant-Medders wells on the Vogtsberger leases in the German emigration lands 4 miles to the southeast. Another line consisting of 3 and 4-in. pipe will connect with Shell production on Block 74, A.T.N.C.L. Survey, and the southern exploitation wells on L. F. Wilson land, Block 73, the same survey. This will traverse south from the main line.

ADDS 154,000 BBL. TO OIL-CARRYING CAPACITY OF TANKER FLEET



Newest tanker of the Atlantic Refining Co. fleet, the S.S. E. H. Blum, is taken in tow by tugs after being launched at the Chester, Pa., yards of the Sun Shipbuilding & Dry Dock Co. The vessel will operate between Texas Gulf ports and Philadelphia. The new tanker has a cargo capacity of 154,000 bbl. of crude. Mr. Blum, honored in naming the boat, is vice president of Atlantic in charge of production. He was the subject of the "Who's Who" feature in The Oil and Gas Journal of March 20, Page 103.

PROGRAMS AND MEETINGS

New Developments Feature Natural-Gasoline Program

The introduction of a new charcoal method for determining the gasoline content of natural gas, new volume-correction factors for liquefied petroleum gases, and new knowledge on the variables in Reid vapor pressure determinations will be among the technical reports featuring the twentieth annual convention of the Natural Gasoline Association of America, April 23-25, in the Baker Hotel, Dallas, Tex.

One research project of the technical committee, concerned with the possible standardization of apparatus and procedure in low-temperature fractional distillation, will be given its first public presentation in a paper by C. E. Wharton and E. A. Montgomery, Hanlon-Buchanan, Inc., Gladewater, Tex. In this project 15 different laboratories of large companies have been cooperating for over a year in the exchange and analysis of identical gas samples in a study of duplicability of results. All of this data has been correlated and the comparative results are of unusual interest to the industry.

A high-pressure-gas session will attract the attention of engineers engaged in repressuring, pressure maintenance and recycling operations with such papers as "Dehydration in High-Pressure-Gas Operations," by R. A. Carter, Continental Oil Co., Ponca City, Okla. This paper will have a prepared discussion by Dr. G. G. Brown and Dr. Donald Katz, University of Michigan. Of interest to all plant engineers will be the discussion of H. W. Harts, Warren Petroleum Corp., Tulsa, on "Close Fractionation in the Manufacture of Special Products at Natural-Gasoline Plants. The paper will be discussed by J. L. Gallagher, Sinclair Prairie Oil Co., Tulsa.

In addition to an address by George P. Bunn, Phillips Petroleum Co., president of the association, a feature of the general opening session will be an address by Elmer Schmidt, vice president, Lone Star Gas Co., Dallas, Tex., whose subject will be "Natural Gas and Gasoline in National Defense." During this same session, Dr. F. H. Dotterweich, Texas A. & I. College, Kingsville, Tex., will present a paper on "Useful Products From Natural Gas."

Other scheduled papers of wide interest are: "Safety in Handling, Shipping and Marketing of Liquefied Petroleum Gases," by G. L. Brennan, Philgas division, Phillips Petroleum Co., and "Compressor Losses Caused by Orifice Meters," by V. E. Middlebrook and Jed Burnham, Shell Oil Co., Inc. The "Operating Kinks" session will again occupy most of the last convention day. In recent years this program feature has grown in size and popularity until it has become a virtual mine of information on unique and practical operating methods and practices.

Elmer Schmidt, vice president of Lone Star Gas Co., Dallas, Tex., whose address on natural gas and gasoline in national defense will be a feature of the meeting

Free Enterprise Urged At Dinner for Cullen

SAN ANTONIO, Tex., Mar. 25.—National defense is best served by the petroleum industry under a system of private initiative and development, George A. Hill, Jr., vice president of the South Texas Chamber of Commerce, declared here last week at the chamber's fourth annual Oil Men's Jubilee. The jubilee honored H. R. Cullen of Houston.

"National defense and national welfare are best promoted and served by the extensive and efficient development of petroleum, an essential and indispensable weapon of national defense, through the media of private capital, initiative and management in a free competitive system, capable of quick mobilization for emergent national service," Mr. Hill said.

Canadian Gas Association Will Hold Joint Meeting

CHATHAM, Ont.—A joint convention of the Canadian Gas Association and the Natural Gas and Petroleum Association of Canada will be held at Hamilton, Ont., in May. The Canadian Gas Association will hold its sessions May 20 and 21, and the Natural Gas and Petroleum Association on May 22 and 23.

CALENDAR OF EVENTS

April

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS, twenty-sixth annual meeting, Rice Hotel, Houston, Tex., April 2, 3, and 4.

AMERICAN CHEMICAL SOCIETY, St. Louis, Mo., April 7-11.

MIDWEST POWER CONFERENCE, fourth annual meeting, Palmer House, Chicago, April 9-10.

PERMIAN BASIN ASSOCIATION, third annual convention, Lubbock, Tex., April 14.

SOUTHWESTERN GAS MEASUREMENT SHORT COURSE, College of Engineering, Oklahoma University, Norman, Okla., April 15-17.

WESTERN PETROLEUM REFINERS ASSOCIATION, annual meeting, Arlington Hotel, Hot Springs, Ark., April 16-18.

AMERICAN PETROLEUM INSTITUTE, eastern district, Division of Production, regular spring meeting, William Penn Hotel, Pittsburgh, Pa., April 17-18.

NATURAL GASOLINE ASSOCIATION OF AMERICA, annual convention, Baker Hotel, Dallas, Tex., April 23-25.

PETROLEUM INDUSTRY ELECTRICAL ASSOCIATION, Mayo Hotel, Tulsa, April 23-25.

NATIONAL PETROLEUM ASSOCIATION, semi-annual meeting, Hotel Cleveland, Cleveland, Ohio, April 24-25.

PETROLEUM AND NATURAL GAS CONFERENCE, State College, Pa., April 25-26.

May

AMERICAN GAS ASSOCIATION, Natural Gas Section, Dallas, Tex., May 5-8.

WEST TEXAS GEOLOGICAL SOCIETY, annual spring field trip, starting at Fort Worth and ending at Midland, May 10-11.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Chicago, May 19-21.

AMERICAN PETROLEUM INSTITUTE, eleventh midyear meeting, Mayo Hotel, Tulsa, May 19-22.

NATIONAL ASSOCIATION OF PURCHASING AGENTS (Oil Company Buyers' Group), Stevens Hotel, Chicago, May 26-29.

NATIONAL OIL SCOUTS AND LAND MEN'S ASSOCIATION, annual convention, Dallas, Tex., May 29-31.

June

SOCIETY OF AUTOMOTIVE ENGINEERS, summer meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., June 1-6.

ILLINOIS - INDIANA PETROLEUM ASSOCIATION, ninth annual petroleum conference, Robinson, Ill., June 7.

KENTUCKY OIL AND GAS ASSOCIATION, midyear meeting, Lexington, Ky., June 20-21.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, annual meeting of Petroleum Division, Kansas City, Mo., June 16-20.

PENNSYLVANIA GRADE CRUDE OIL ASSOCIATION, annual meeting, Bradford, Pa., June 19-20.

AMERICAN SOCIETY FOR TESTING MATERIALS, forty-fourth annual meeting, Palmer House, Chicago, June 23-27.

September

AMERICAN CHEMICAL SOCIETY, Atlantic City, N. J., September 8-12.

NATIONAL PETROLEUM ASSOCIATION, thirty-ninth annual meeting, Hotel Traymore, Atlantic City, N. J., September 17-19.

SOCIETY OF AUTOMOTIVE ENGINEERS, national tractor meeting, Schroeder Hotel, Milwaukee, Wis., September 25-26.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, Petroleum Division, East Texas chapter, annual convention, Adolphus Hotel, Dallas, Tex., September 25-27.

October

TEXAS MID-CONTINENT OIL AND GAS ASSOCIATION, twenty-second annual convention, Beaumont, Tex., October 9-11.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, Petroleum Division, Dallas, Tex., October 16-18.

SOCIETY OF AUTOMOTIVE ENGINEERS, national aircraft production meeting, Biltmore Hotel Los Angeles, Calif., October 30-November 1.

CALIFORNIA NATURAL GASOLINE ASSOCIATION, Los Angeles, Calif., October 31.

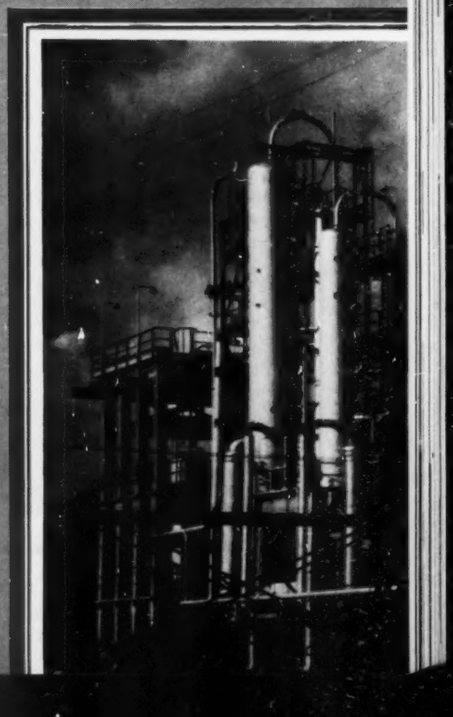
November

AMERICAN PETROLEUM INSTITUTE, twenty-second annual meeting, San Francisco, Calif., November 3-7.

Beginning the Engineering and Operating Section of the

ANNUAL REFINERY NUMBER

Chemistry is revolutionizing oil refining. Already sixty per cent of our motor fuel is synthesized by cracking, reforming, isomerizing, alkylating or polymerizing petroleum fractions. And we see the industry building more laboratories and its researchers predicting startling things ahead. The national defense program has undoubtedly quickened the pace but actually the work of making better products and more of them at less cost has been going on at a fast rate for nearly a quarter century and the benefits will continue long after the present emergency has passed into history.



The Texas Company Completes New Motor Laboratory

By J. J. MIKITA and C. E. CUMMINGS
The Texas Company

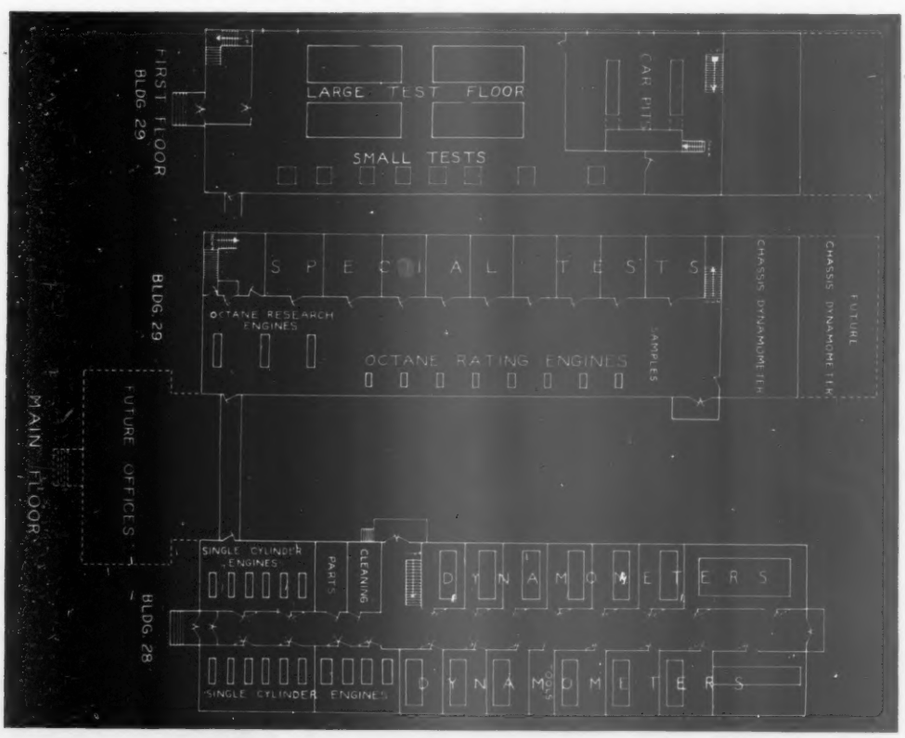
TEN years ago the Texas Co. sought means for centralizing much of its scattered and increasing development activities. It preferred a laboratory within reasonable distance of the managerial offices in New York City, yet suburban enough to assure freedom of activity and wholesome living conditions for the personnel. The result was the establishment of Beacon Laboratory at Beacon, N. Y., 60 miles north of New York City, near the Hudson River.

Steady growth of general laboratory activities and the increased importance of mechanical research and testing have resulted in recently adding a new engineering laboratory.

Fig. 2—View of southeastern corner of the laboratory. The building in the foreground is the two-story general laboratory building

Functions of the Engineering Laboratory

Housed in this new laboratory the engineering research department performs vital functions in research, testing, service and standardization. Each function dovetails into a general scheme of work, the ultimate objective of which is the development of new and improved fuels and lubricants. *Research* studies in combustion and lubrication form the ground work for other activities. *Testing*, an important phase of the work, involves, (1) the determination of the suitability of products for commercial equipment, (2) the study of commercial equipment for anticipation of future fuel and lubricant requirements, and (3) the evaluation of experimental automotive, diesel and aircraft fuels and lubricants, rear axle and transmission lubricants, greases and specialized products. *Service* activities consist of "trouble shooting" to aid operators of bus, truck, passenger car, aircraft and other equipment. The important task of *standardization* of antiknock equipment in the 16 laboratories of the Texas Co. and the standardization of mechanical equipment for production control at refineries is the function of a standardization group. The pursuit of all these activities is the work of the engineering research department.



Layout of new motor laboratory with provisions shown for expansion

General Laboratory Design

The design of any laboratory building which will meet the varied future requirements is always a problem. The design adopted is shown in plan in Fig. 1.

To segregate vibration and noise, the laboratory was divided into two structurally separate buildings, a one-story dynamometer laboratory, and a two-story general laboratory. Fig. 2, a photograph of the laboratory, shows the advantage taken of the hillside terrain in construction.

Some of the features of the building include individual rooms for each full-scale engine and dynamometer, a unit ventilating system in each room, acoustical blocks on the walls and ceilings of all engine rooms, and individual exhaust systems for each engine. To prevent transmission of vibration from engines to the building, all engines and dynamometers are mounted on slotted cast-iron bed plates flush with the floor but independent of the building structure. These bed plates are set in concrete having a weight at least 30 times the estimated unbalance engine force. Insulation of the concrete from bedrock is obtained through a layer of foundation cork.

A feature adopted for ease of housekeeping and unhampered use of I-beam trolleys is the elimination of overhead piping. Condenser water, fresh water, air, gas, vacuum, and nine fuel lines, together with electrical-service conduits, are housed in a gallery underneath the floor. Service take-offs are run through the floor at the edge of each engine and dynamometer bed plate.

Lubricant Research and Testing

The broad program of work in the laboratory may be divided into two general classifications, lubricants and fuels. Available for lubrication research and testing are a variety of specially designed test equipment, standardized equipment, single-cylinder engines, full-scale engines, and a

fleet of current-model cars. Experimental lubricants developed by the chemists and chemical engineers, when submitted to the mechanical laboratory, start an arduous journey of testing; first, simple laboratory tests, followed by single-cylinder engine tests and full-scale engine tests. A few experimental products survive to be road tested and occasionally one will stand out sufficiently to merit field tests. Successful field performance concludes the development history of a new product.

Experimental lubricants, before reaching the engineering research department for testing, must first pass laboratory tests conducted by the various chemical departments. As an illustration, experimental automotive lubricants are not tested in mechanical equipment until it has been shown that they have satisfactory oxidation stability as determined in glass equipment, unusual detergency and dispersion characteristics, resistance to water, and desirable physical characteristics and other properties. Satisfactory results in the above tests start the experimental product on the mechanical tests discussed on the following pages.

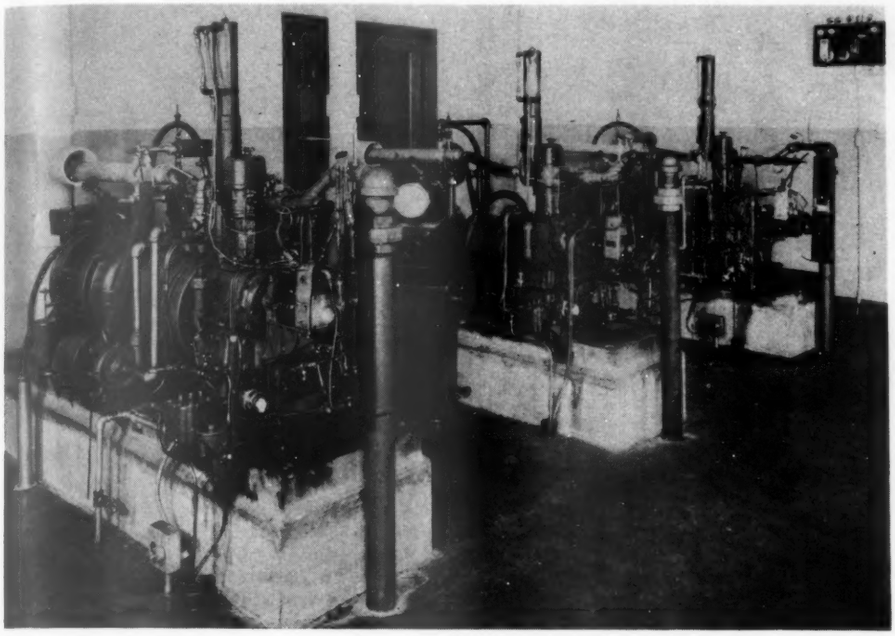


Fig. 3—Details of the supercharged engine installation

Air for supercharging is obtained from the plant air line through reducing valves to surge tanks directly underneath the floor in front of the engines. The air passes through large vertical pipes into the intake manifolds. For ease of operation, carburetors have been eliminated. The fuel is injected directly into the manifolds with conventional diesel jerk pumps and spring-loaded nozzles. Ethylene glycol evaporative cooling is used to obtain high cylinder temperatures and oil coolers are provided for oil-temperature control.

Laboratory Oxidation and Bearing Corrosion Tests

Laboratory oxidation stability is determined by the familiar Underwood test and the MacCoull corrosion test, in addition to stability studies by other departments in the laboratory. The MacCoull corrosion test employs a ⅝-in. diameter by 1-in. long cylindrical alloy bearing rotated on a stationary shaft at 3,600 r.p.m. Both bearing and journal are submerged in the test oil which is contained in a 250-cc. beaker. Ten such assemblies are located in an electrically heated aluminum block and 10 tests are conducted simultaneously. In the operation the oil is pumped continuously through the bearing and at a temperature of 350° F. unsatisfactory oils oxidize and cause bearing corrosion.

Such laboratory tests can have significance only if correlated with engine tests. In the case of the MacCoull corrosion test, correlation with full-scale engine-bearing corrosion tests is excellent.

Film Strength and Oiliness

Timken, Almen and S.A.E. machines are available for "film strength" determinations of hypoid and other lubricants.

The frictional characteristics of lubricants under conditions of boundary lubrication may be determined on a large bearing-test machine which permits coefficient-of-friction measurements over a wide range of loads and speeds. For study of lubrication under thick-oil-film-conditions, journal running position and film thickness can be determined by electrical means. Fundamental data obtained with this machine are utilized in solutions of a host of problems continually confronting the users of lubricants.

Single-Cylinder Engine Tests

The ring-sticking characteristics of oil are studied in 3¼-in.-bore single-cylinder engines coupled to either 900 or 1,200-r.p.m. induction motors. Operation is at 375° F. jacket temperature and ring sticking is determining by visual inspection of the piston. In ring-sticking research, which is continually in progress, provision is made for piston-temperature measurements and stroboscopic observation of the piston in actual operation is possible through a window in the cylinder wall.

The knowledge of the mechanism of ring sticking and the influence of operating variables serves not only operators of commercial equipment but also designers of engines.

Ring sticking, piston deposits, cylinder wear and general engine cleanliness under extremely severe operating conditions may be studied in supercharged single-cylinder counterbalanced engines capable of operation at 300 lb. per sq. in. indicated mean effective pressure and 3,600 r.p.m. An extensive research program on cylinder and piston-ring wear under extremely high outputs has been in progress for the past 4 years. The effect of operating conditions, cylinder finish, cylinder and ring materials, and other variables is under investigation. Research work of this nature is important for a complete understanding of a problem, and subsequent establishment of test methods for evaluation of products.

Other single-cylinder engines are used for evaluating lubricating oils with respect to cylinder wear at low operating temperatures. Small 2⅝-in.-bore engines operating at 1,800 r.p.m. are used for evaluating the varnishing tendencies and the detergency of lubricating oils.

Fig. 4 (right)—Typical individual engine-test room with electric dynamometer and diesel-engine installation

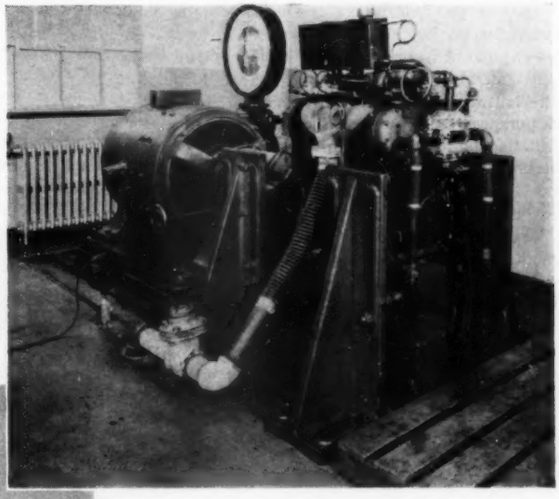
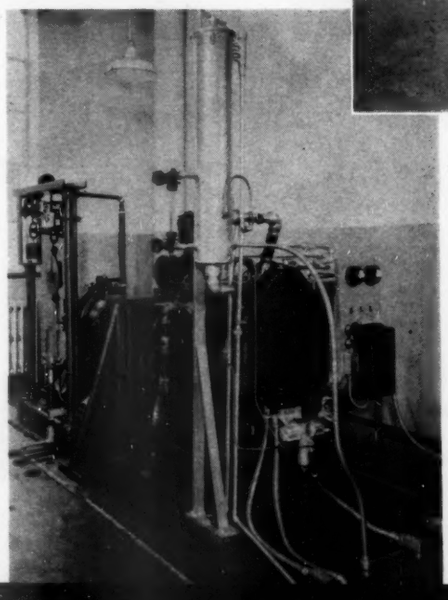


Fig. 5 (below)—Typical installation of a light passenger-car engine coupled to an eddy-current dynamometer. Note provision for bringing service lines through the floor at the edge of the engine bed plate



Full-Scale Engines

Several full scale engines with either electric or eddy-current dynamometers are provided for research testing and service work. This battery of engines consists of 5¾-in.-bore by 8¼-in.-stroke single-cylinder Caterpillar engines, General Motors Model 71 engines, six-cylinder automotive-type diesels, and automotive engines. Several heavy-duty truck engines are available as needed.

Fig. 4 shows a typical individual test room with

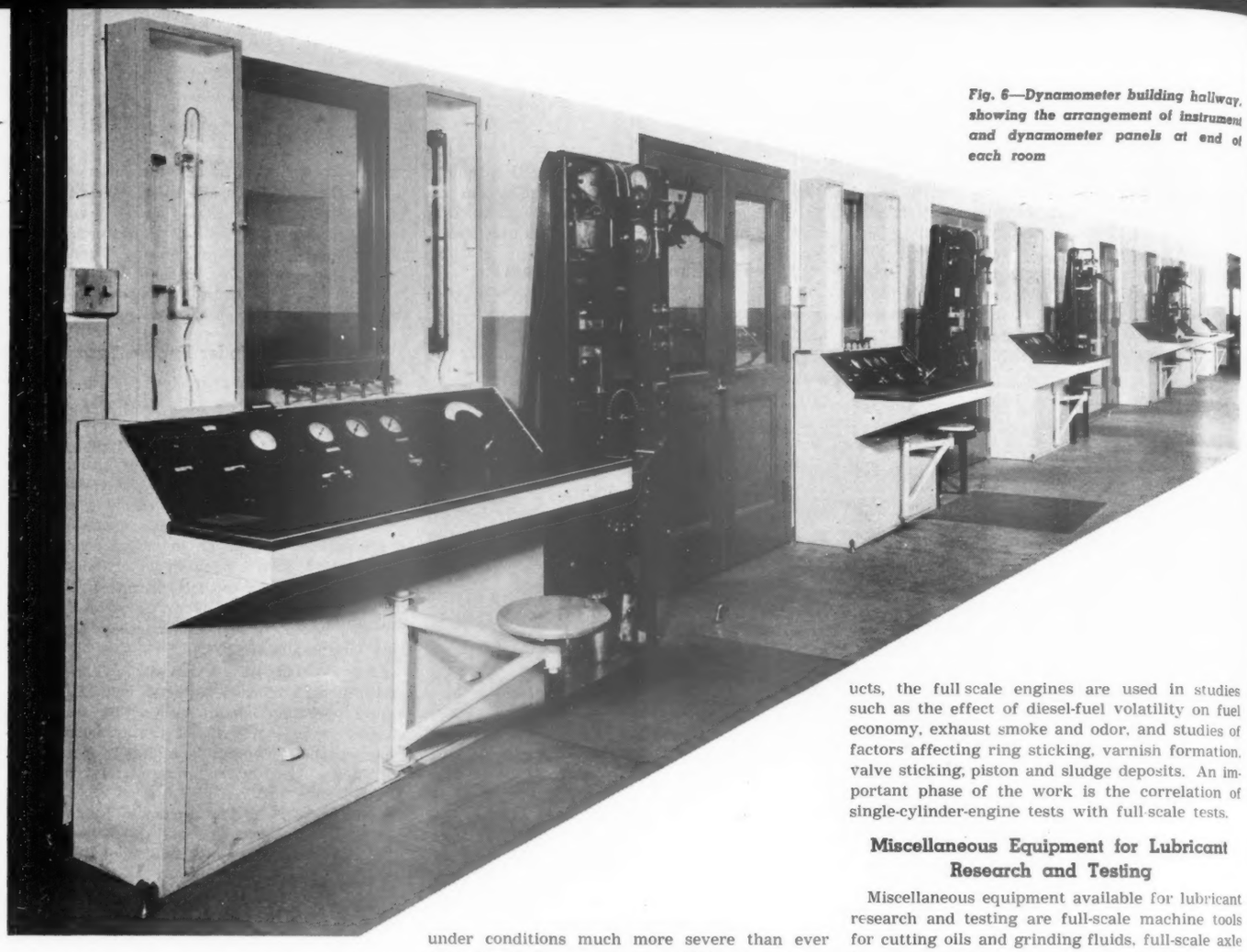


Fig. 6—Dynamometer building hallway, showing the arrangement of instrument and dynamometer panels at end of each room

electric dynamometer and diesel-engine installation and Fig. 5, a typical installation of a light passenger-car engine coupled to an eddy-current dynamometer.

One of the features of the dynamometer laboratory is the arrangement for the control of engines operating on long-time lubricating-oil tests. All controls and instrumentation are located in the hallway outside the test rooms. Fig. 6 gives a perspective of one side of the dynamometer-building hallway, showing the arrangement of instrument and dynamometer panels at the end of each room, so that the test can be readily viewed through the safety-glass window.

Fig. 6 also illustrates the control and instrument-desk design which was adopted as standard for all engine installations. The glass-covered cases at the top of the desk provide for protected installation of manometers and fuel burettes, with the area between for the mounting of extension valves, handles for control of cooling water, fuel, etc. The inclined instrument panels are arranged in three sections, easily removable, so that changes of arrangement may be made with a minimum of effort. Each desk contains panels with a built-in potentiometer and multipoint switch, electric stop clock, tachometer, and the necessary pressure gages and special instrumentation. Fuel-flow-rate determinations are made by means of a graduated burette which is filled or discharged through solenoid-operated valves controlled by switches conveniently located on the instrument panel.

Adequate safety devices to protect against low-water pressure, loss of power, loss of field excitation or low oil pressure, are provided at each control desk. The grouping of the controls in the center hallway together with the protective devices, makes it possible for an observer to maintain several operations concurrently when performing tests of long duration under uniform conditions.

The passenger-car and truck engines operated under conditions much more severe than ever encountered in service are utilized to test the corrosiveness of oils to alloy bearings and the varnish and sludge formation tendencies of oils.

Lubricants designed for diesel engines are evaluated for corrosiveness, ring sticking, piston deposits, wear and general engine cleanliness in full-scale equipment, the equipment in which the product would be used if marketed.

In addition to the testing of experimental products, the full scale engines are used in studies such as the effect of diesel-fuel volatility on fuel economy, exhaust smoke and odor, and studies of factors affecting ring sticking, varnish formation, valve sticking, piston and sludge deposits. An important phase of the work is the correlation of single-cylinder-engine tests with full-scale tests.

Miscellaneous Equipment for Lubricant Research and Testing

Miscellaneous equipment available for lubricant research and testing are full-scale machine tools for cutting oils and grinding fluids, full-scale axle tests for studying the wear and scuffing characteristics of hypoid lubricants, and a full-scale set-up for evaluating wheel-bearing lubricants. The latter setup is a portable unit so that the test may be conducted in a cold room at —40° F. or in a hot room at 120° F., simulating every operating temperature encountered in service. A suitable loading device permits studies at loads greatly exceeding those ever encountered in the field.

Fig. 7—Maintenance facilities provided for automobile-test fleets. Pits allow simultaneous working on both top and underside of car. Connecting passage between the pits is large enough for a work bench so that movement of engine parts is kept at a minimum

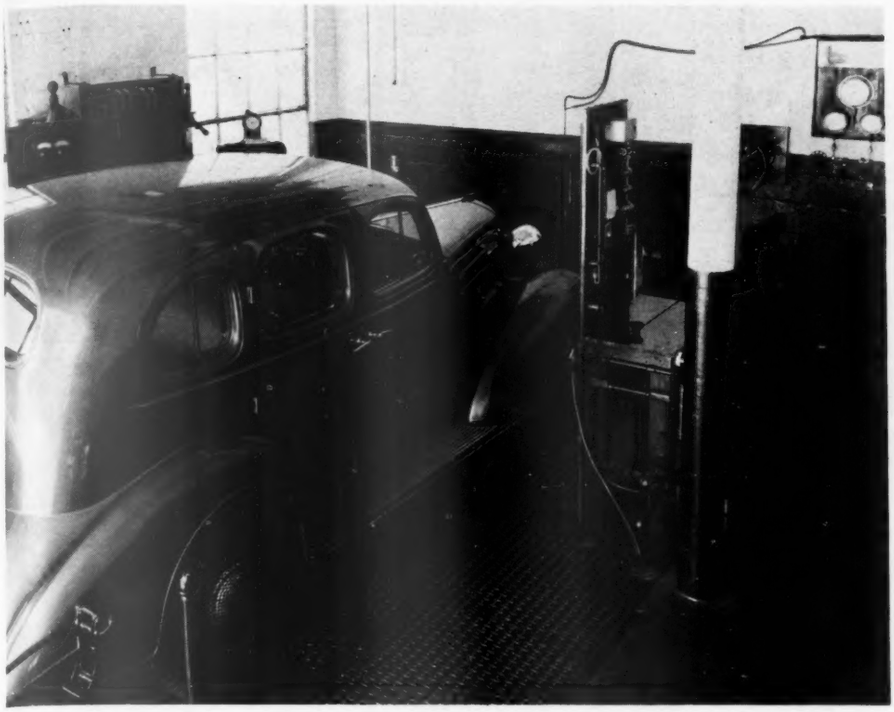


Fig. 8—Chassis dynamometer in old laboratory building The dynamometer in the new engineering building is of same design and construction. Controls for load absorption and motoring are located on a movable panel opposite the left front window of car

Fuel Research, Testing and Standardization

Studies of fuels are conducted in much the same manner as studies of lubricants. Preliminary single-cylinder tests are followed by full-scale tests and finally tests in the actual equipment for which the fuel is designed.

Standard C.F.R.-A.S.T.M. antiknock engines and standard cetane-rating engine are provided for routine evaluations of motor, aviation and diesel fuels. Provision is made for refrigeration storage of gasoline samples to insure against loss of light ends, a necessary precaution for the accurate determination of octane values.

Supercharged experimental arrangements incorporating dynamometers in addition to the conventional constant-speed synchronous motors are available for aviation-fuel studies. These engines are equipped with high-speed crankcases which permit operation to 3,600 r.p.m. Combustion phenomena are studied with the aid of a point-to-point indicator or a condenser-microphone-type indicator used in conjunction with a 9-in. cathode ray oscillograph. The latter indicator permits pressure-time or rate-of-change of pressure-time studies of individual cycles or the average of any number of cycles.

Severe midwinter operation can be simulated in cold rooms for studying the effect of fuel volatility on starting and warming up. A cold room equipped with a modified chassis dynamometer is utilized in determining the starting and warming-up characteristics of current-model cars.

Research on fuel distribution in manifolds and studies of automatic chokes and their performance is carried on in engines in a refrigerated room.

Chassis Dynamometer

Chassis dynamometers are used to study the road antiknock performance and the vapor-locking tendency of fuels, the performance of new-model cars with respect to fuel economy, octane requirements, fuel and lubricating-oil temperatures, power output, volumetric efficiency, spark-advance characteristics, and a host of other factors affecting fuel and lubricant requirements. A photograph of the dynamometer in the old laboratory is shown in Fig. 8. With these dynamometers road testing is carried out in a laboratory room. Every condition encountered on the road can be simulated, acceleration, deceleration, uphill, and downhill from 10 to 100 m.p.h., and temperatures from 10° F. above atmospheric to 130° F. can be obtained with wind velocities corresponding to the car speed. Extensive correlations between the chassis dynamometer and road tests have proved that identical results can be obtained on the dynamometer with far greater day-to-day uniformity, due to the ability to control atmospheric conditions and lack of interference from traffic, road, and weather conditions.

Fig. 9 is a line drawing showing general construction details of the chassis dynamometer. The design originated and used for the past 10 years at Beacon incorporates drums of 5-ft. ½-in. diameter, made of compressed paper, and weighted to provide variable inertia to correspond to cars of different weights. The drums, mounted on axles of a standard large-truck rear-axle assembly, are cradle-mounted so that the torque reaction is transmitted directly to a scale calibrated to express the draw-bar pull. The propeller shaft of the rear axle drives a large blower having torque-speed characteristics corresponding to the average level-road torque required of modern passenger cars. Consequently, no operational adjustments are required to operate a car under level-road constant-speed conditions. The inertia of the system further provides automatically the level-road loads for acceleration or deceleration. A direct-current generator with dynamometer-type controls is suitably connected to provide power absorption for full-throttle conditions. The generator is also used as a motor for determining car friction.

The blower outlet has a movable nozzle section which can be adjusted to the varying car lengths and provides cooling of the engine closely approximating that obtained on the road with zero wind velocity. The specially designed blower has in addition to its level-road torque requirement, air-discharge characteristics which give velocities at the nozzle closely corresponding to the car road speed.

Road Performance of Fuels

It cannot be denied that the most important requirement of a fuel is satisfactory road performance. It is in the determination of this performance that the chassis dynamometer fulfills one of its important functions. To illustrate, consider the antiknock characteristics of motor fuels. Single-cylinder engines, while useful for fundamental studies of knock and production control of antiknock characteristics, do not indicate the true performance in actual service. True antiknock performance can be determined only by tests in actual cars.

In utilizing the chassis dynamometer for this work, antiknock qualities of fuels are determined under road conditions in full-scale equipment, the equipment in which fuels will be used by the customer.

So important is this road octane-testing of motor fuels that consideration is being given to the installation of an additional unit at Beacon Laboratory.

Summary

The conviction that the quality of a product can best be determined by testing it in the equipment in which the product will be used played an important role in the design of the new engineering laboratory. It is believed that experimental products should pass not only small-scale accelerated laboratory tests but also severe full-scale tests whether the product be for stationary or automotive diesels, passenger-car or aviation engines, refrigerators or railway air pumps. Only after satisfactory performance in full-scale tests and in field tests under actual service conditions can it be considered that a new product has been developed. This laboratory was designed to fulfill these requirements.

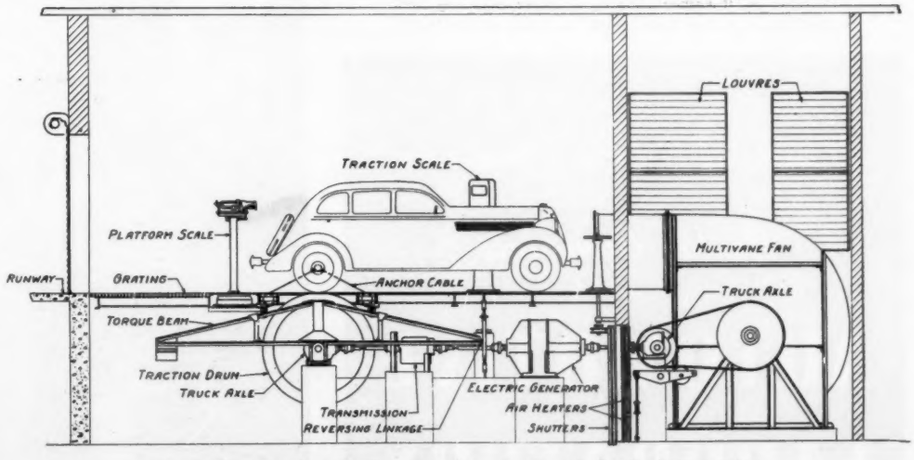
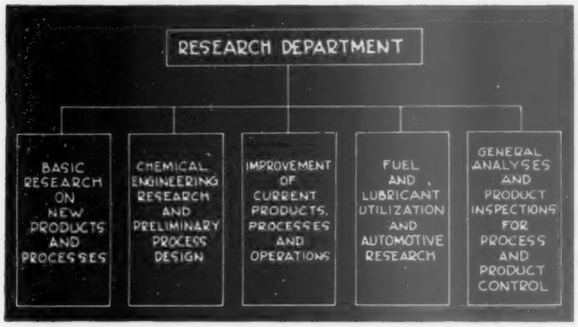
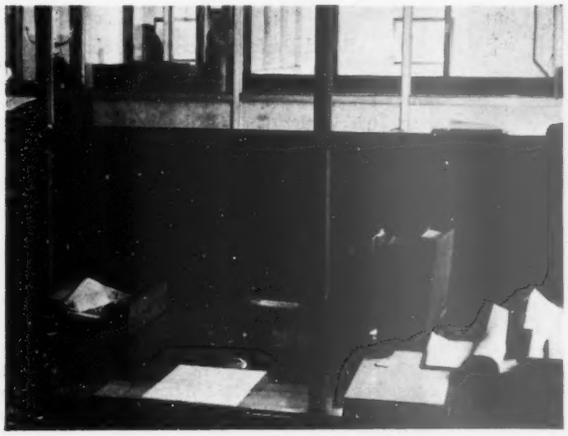


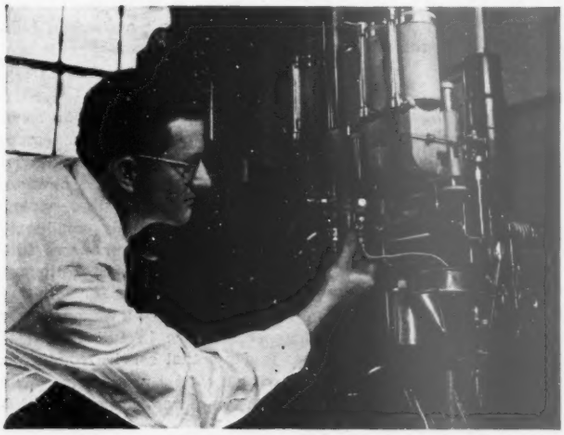
Fig. 9—Line drawing showing general construction of chassis dynamometer


RESEARCH DEPARTMENT
BASIC RESEARCH ON NEW PRODUCTS AND PROCESSES
CHEMICAL ENGINEERING RESEARCH AND PRELIMINARY PROCESS DESIGN
IMPROVEMENT OF CURRENT PRODUCTS, PROCESSES AND OPERATIONS
FUEL AND LUBRICANT UTILIZATION AND AUTOMOTIVE RESEARCH
GENERAL ANALYSES AND PRODUCT INSPECTIONS FOR PROCESS AND PRODUCT CONTROL

Organization chart showing division of work in the research department of the Standard Oil Co. (Ind.)



Type of office provided for laboratory staff members

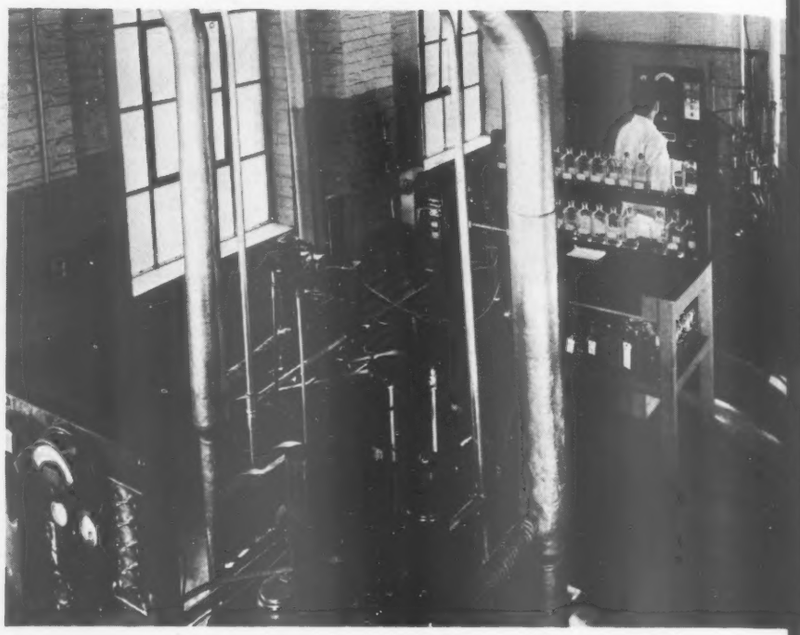


Closeup of CFR engine showing operator adjusting fuel-control knob below three small gasoline supply tanks

Standard Oil Co. (Indiana) Builds Complete

AUTOMOTIVE LABORATORY

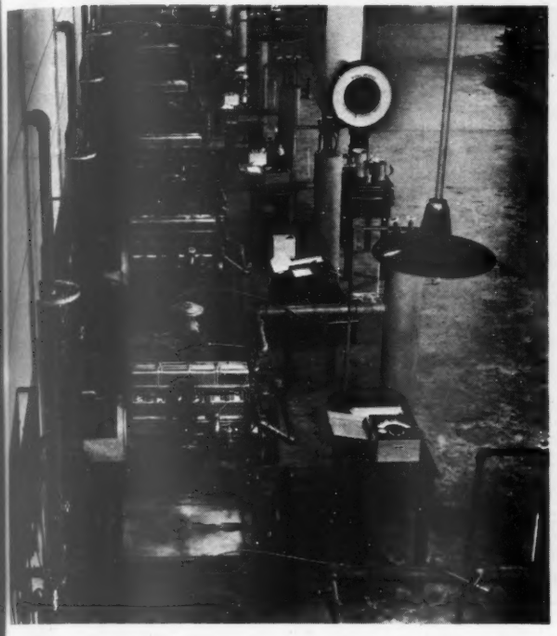
Automotive laboratories at Whiting, Ind., which provide 25,000 sq. ft. of floor space, or about six times the area available 10 years ago



Above: Corner of the knock-testing laboratory, including views of CFR single-cylinder, variable compression engines for testing motor fuels. Below: Engine used for the evaluation of diesel fuels for ignition quality or cetane number

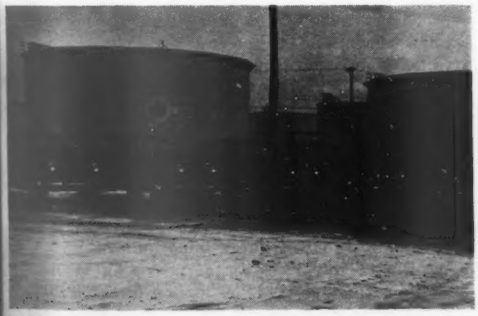
Current-model automobile engine installed in sound-insulated room. Setup is designed for operation over a wide variety of conditions

General view of laboratory chassis dynamometer. Equipment calibrates road-test vehicles. Controls provide for range of operating conditions



Engines installed in main testing room, each with full recording equipment and fan brake for loading

Closeup of engine in main testing room. Operator is inspecting filter during test run to observe detergency properties of oil



Above: Part of test-car fleet maintained for evaluating changes in characteristics of new fuels and lubricants. Below: Instrument panel on a test car

By D. P. BARNARD and A. H. FOX

Assoc. Director of Research Automotive Engineer

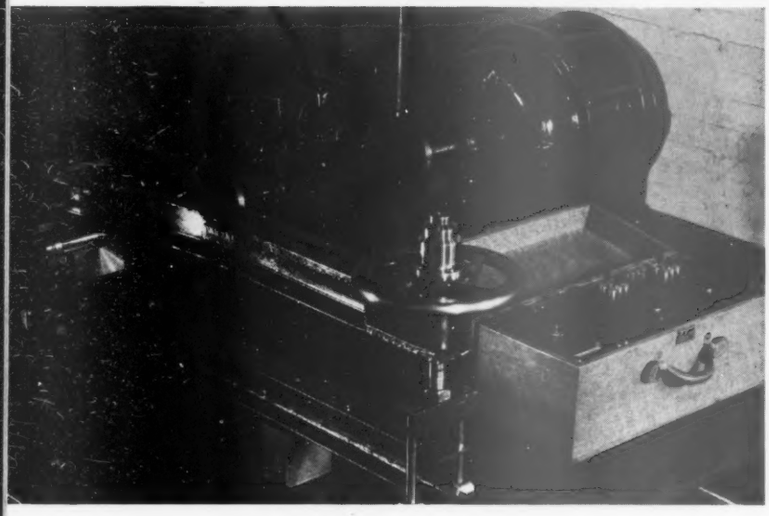
Standard Oil Co. (Indiana), Whiting, Ind.

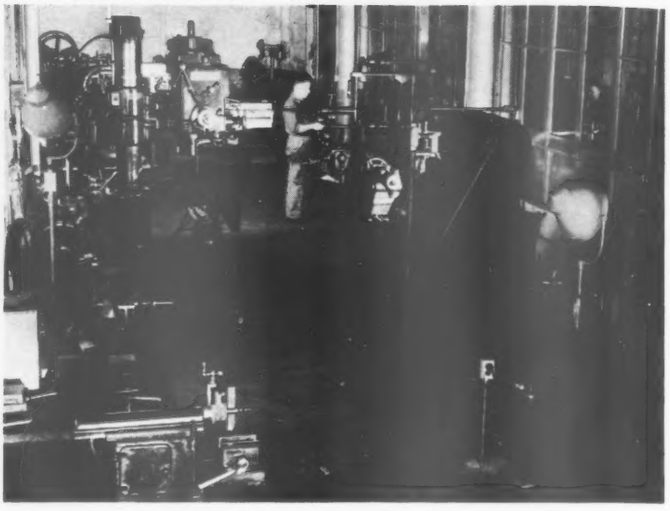
THE first automotive laboratory planned and constructed for the specific purpose of testing and developing motor fuels and lubricants was (insofar as the present authors are aware) erected by the Standard Oil Co. in 1925, at Whiting, Ind. This laboratory, comprising some 3,500 sq. ft. of floor space, was considered generously oversized at the time inasmuch as only two major problems —development of a high-antiknock-quality gasoline and antichatter Model T Ford lubricating oil —were considered of pressing importance. It was not long, however, until these original laboratory facilities were outgrown, due to the rapid technical advance of the motor vehicle and the accompanying requirements for improved fuels and lubricants. By 1936 the automotive laboratory had taken over space in several other nearby buildings and as demands for still more facilities continued to mount it became necessary to provide for a substantial increase in mechanical testing equipment and personnel. This was accomplished in 1939 by remodeling a portion of an old but substantial building familiarly known as the "Old Mill House." The new laboratory provides more than 25,000 sq. ft. of floor space or an area over six times greater than considered adequate a little more than a decade ago. It is the purpose of this article to outline the functions of the laboratory and to describe its facilities and equipment.

Functions of the Automotive Laboratory

The automotive laboratory is one of the several divisions of the research department. The relation between these several divisions is shown in Fig. 1. It will be noted that one division is charged with product development, another with exploratory research and the development of new fuels, lubricants and miscellaneous products, another with process design, etc. Current high degree of specialization in the manufacture of petroleum products requires that the various research and development activities be provided with complete facilities for product appraisal. For the Indiana company, as for other organizations engaged in the manufacture and distribution of automotive fuels and lubricants for internal-combustion engines, the chief requirement is for automotive testing facilities. The following very incomplete list of problems will perhaps serve to exemplify this point in greater detail:

1. Determination of motor-gasoline properties required for satisfactory and economical engine operation. (These change from year to year with the advent of new car, truck, and tractor models





Upper left: General view of one of two diesel engines employed in perfecting and inspecting "heavy-duty" bus and truck-engine lubricating oils. Upper right: View of the type of equipment installed on third floor of the laboratory. Shown is a "constant-shear viscometer" used in evaluating the viscosity characteristics of certain types of lubricants and greases. Center, left: Apparatus used in testing heavy greases, particularly those used in locomotive driving and car journals. Center, right: General view of the laboratory machine shop, a portion of which is devoted to test-engine repair and maintenance. Immediately above: Apparatus used in testing automotive spring lubricants

and with the deterioration of existing vehicles.)

2. Development of knock-testing methods necessitated by changing requirements. (This applies to motor, aviation, and diesel fuels.)

3. Technical supervision and conduct of all knock tests.

4. Appraisal of engine performance accompanying changes made in motor, aviation, and diesel fuels.

5. Evaluation of the behavior of fuels and lubricants as affected by changes in (*a*) engine design, and (*b*) refining equipment and technique.

6. Appraisal of existing lubricants in order to determine exact requirements for changes.

7. Appraisal of changes made in the course of motor-oil development.

8. Evaluation of lubricants developed for heavy duty service.

9. Appraisal of fuels and lubricants developed for cold-weather use.

10. Appraisal of transmission and gear lubricants.

11. Appraisal of chassis lubricants.

12. Development of special mechanical tests for use in evaluating industrial products, such as car oils, mill greases, driving-journal compounds, etc.

Each of the foregoing general examples is, of course, composed of several parts. Item 1, for instance, involves road tests to determine octane-number requirements, starting tests for cold-weather operation, vapor pressure permissible without incurring vapor lock, effect of volatility changes in carburetion, etc. In Item 7, as another example, consideration must be given to a number of similar factors, each requiring its own experimental technique, such as sludge formation, ring sticking, carbon deposition, bearing corrosion, wear, oil consumption, "detergency" and many other aspects of oil evaluation. In addition to the problems directly concerned with product improvement, the automotive laboratory is engaged on problems dealing in a more general way with improvements in engine-test methods, much of which is of a cooperative nature. The development of C.F.R. and A.S.T.M. knock-testing methods and equipment for motor, aviation, and diesel fuels, both in the laboratory and in full-scale service, are notable examples.

The situation may be summarized by saying that whereas the automotive laboratory was founded in 1925 on the basis of two major problems plus a few of lesser importance, it is now faced with the necessity of providing facilities for the experimental investigation of a relatively large number of diverse and highly specialized problems. How this is done is described in the following section.

Facilities and Equipment

On the first floor of the new laboratory is located the main testing room, the heavy-dynamometer room, the parts-cleaning room and the knock-testing laboratory. The machine shop is on the second floor as are the offices which provide quarters for the stenographic department and 16 technical men, who, with the assistance of a force of 15 mechanics and helpers, direct and carry out of the work of the automotive laboratory. The small equipment laboratory is on the third floor. Here are located miscellaneous oil and grease-testing equipment and the photographic dark room used for making pictures of engine parts, etc., for record purposes.

An important application of petroleum chemistry has been the manufacture of synthetic rubber from refinery products. Here is a closeup of crude butyl rubber made from petroleum and ready to be made up into automobile tires, hose, floor coverings, tobacco pouches, electric insulation for wires or any one of hundreds of normal uses

CHEMISTRY in Petroleum Refining

By L. N. LEUM
Research and Development Dept., Atlantic Refining Co.

When faced with digesting certain chemical terms which have been injected into modern refinery discussion, many readers are at sea. Even the technically trained mind is not always alert to the refining industry's application of these terms, so here an authority simplifies the terminology in order that a working knowledge can be gained from a discussion of such modern refinery processes as polymerization, alkylation, isomerization, etc. That chemistry and physiochemical phenomena will enter more and more into the operations of the refining industry, cannot be gainsaid.

THE numerous processes which have been developed in recent years or are being developed for the manufacture of high-octane gasoline indicate that petroleum refining is becoming essentially a chemical industry. From the questions that have been asked of the chemists concerning these processes it appears that the engineers and refiners are somewhat confused as to what each process accomplishes. In answering these questions, it is found that the confusion is mainly due to a lack of understanding of the formulas and terminology of the organic chemist.

The formulas of organic compounds may be roughly divided into two types, empirical and structural. In the hydrocarbons the empirical formulas, such as C_6H_{14}, show only the ratio of carbon to hydrogen existing in the compound. This type of formula is insufficient when it is realized that a large number of compounds exist with the same composition. Using the empirical formula C_6H_{14} as an example, there are five different compounds known which conform to this formula. Such compounds having the same composition are called "isomers."

In order to explain the differences in organic compounds having the same composition, structural formulas have been developed. These formulas are based on the concept of "valence" or combining force of the elements. Valence in structural formulas is indicated by means of a short line or dash. For instance the hydrogen atom is known to have a valence of one, and is represented as H—, while carbon in practically all cases has a valence of four and is shown as —C—.

When hydrogen and carbon are united in a compound such as methane the valence line is mutually held and is called a "bond" between the two elements:

Thus the carbon atom has four bonds attached to it, showing that it has a valence of four and each hydrogen atom has one bond showing a valence of one.

Bonds are formed not only between carbon and hydrogen but also between two or more carbon atoms, for example:

ETHANE C_2H_6 PROPANE C_3H_8 BUTANE C_4H_{10} ETC.

These compounds are members of the "paraffin" series of hydrocarbons. In considering the empirical formulas of these compounds, CH_4, C_2H_6, C_3H_8, C_4H_{10}, etc., it will be noted that each one differs from the one preceding by CH_2. Such a series of compounds is called a "homologous series." The empirical formulas of the first three members, CH_4, C_2H_6, and C_3H_8, each represent only one compound inasmuch as an examination of the structural formulas of these compounds show that only one compound of each can possibly exist. However, in the case of C_4H_{10} it is possible to write two structural formulas

N-BUTANE AND ISOBUTANE

In the first case we have a straight chain of carbon atoms, —C—C—C—C—, and in the second a branched chain, C—C—C. The number of isomers possible for any particular empirical formula rapidly increases as the number of carbon atoms increases. For example, C_5H_{12} has three isomers, C_6H_{14} five, and C_8H_{18} eighteen isomers.

For purposes of simplification, structural for-

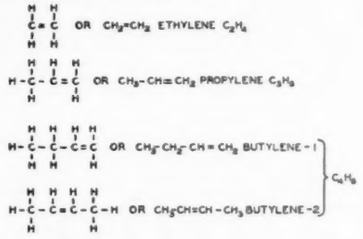
mulas are most often written in the following manner:

CH_3-CH_3 ETHANE
$CH_3-CH_2-CH_3$ PROPANE
$CH_3-CH_2-CH_2-CH_3$ N-BUTANE
$CH_3-CH(CH_3)-CH_3$ ISOBUTANE

In these formulas it is understood that the carbon atoms are joined directly with each other and that the hydrogen atoms, their number indicated by the numerical subscripts, are attached to the carbon atoms to complete their valence.

The hydrocarbons which have been used as examples so far in this discussion are members of the paraffin series which are "saturated" hydrocarbons, that is, compounds which have enough hydrogen to completely satisfy the valence forces of all the carbon atoms. A general empirical formula for this class of compounds is C_nH_{2n+2}, which means that there are two more hydrogen atoms than twice the number of carbon atoms. There are a number of other homologous series where the number of hydrogen atoms available are not enough to satisfy all the valence forces of the carbon atoms. These materials are called "unsaturated" hydrocarbons. The most common type of unsaturation is that shown by the olefin hydrocarbons which have the general empirical formula C_nH_{2n}, i.e., two fewer hydrogen atoms than are found in the corresponding paraffin hydrocarbon.

To show the position of unsaturation in olefin hydrocarbons a "double bond," =, is used in structural formulas. For example



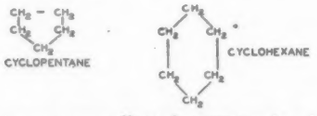
A double bond is simply a means of illustrating that the two carbon atoms to which it is attached are deficient in hydrogen. This deficiency in hydrogen makes these two carbon atoms much more reactive than the others.

Hydrocarbons of the series C_nH_{2n-2} may have either two double bonds or a triple bond, ≡ . Compounds containing the triple bond are rare in petroleum work so they will not be discussed here. However, hydrocarbons with two double bonds, diolefins, are quite often found in cracked gasolines and greatly contribute to its instability. Compounds with two double bonds are known which have the following types of formulas:

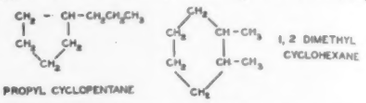
(1) $CH_2-CH_2-CH=C=CH_2$
(2) $CH_2-CH=CH-CH=CH_2$
(3) $CH_2=CH-CH_2-CH=CH_2$

Compounds of the first type, with a carbon atom having two double bonds attached, can be prepared by special chemical reactions but they are very unstable and would not be found in petroleum products. Compounds of the second and third type are both found in petroleum products especially in cracked naphthas. Compounds of the second type are unique in their ease of polymerization due to their "conjugated" system of double bonds, that is, a system of alternate double and single bonds.

Besides the paraffin and olefin hydrocarbons there are two other general types of hydrocarbons commonly found in petroleum and its products. These are the naphthenic hydrocarbons and the aromatic hydrocarbons. The former materials are hydrocarbons which contain a five-carbon-atom or a six-carbon-atom ring. The simplest naphthenic hydrocarbons that might be found in petroleum would be:

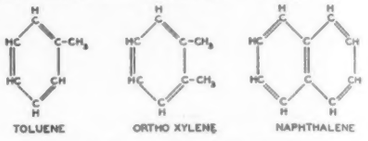


Somewhat more complicated compounds of this ring type would be illustrated by the following:



Aromatic hydrocarbons are those which contain a benzene ring. Benzene itself is a six-carbon-atom ring with one hydrogen attached to each carbon atom:

Examination of this formula shows that there is a conjugated system, alternate single and double bonds, extending around the ring. This situation gives properties to the compound which are entirely different from those found in the paraffin and olefin hydrocarbons. Other aromatic hydrocarbons include the following:



Naming of Hydrocarbons

The names of organic compounds fall into one of three classes, the Geneva system, substitution system, or nonsystematic names. The latter names are those which were given to compounds in the infancy of organic chemistry before attempts were made to systematize naming or have crept into the vocabulary of chemists due to the need for a simple name for materials widely used commercially. Historically speaking, the substitution system was the first attempt at systematic naming. It was soon found to be inadequate and the Geneva system was developed for naming all types of organic compounds.

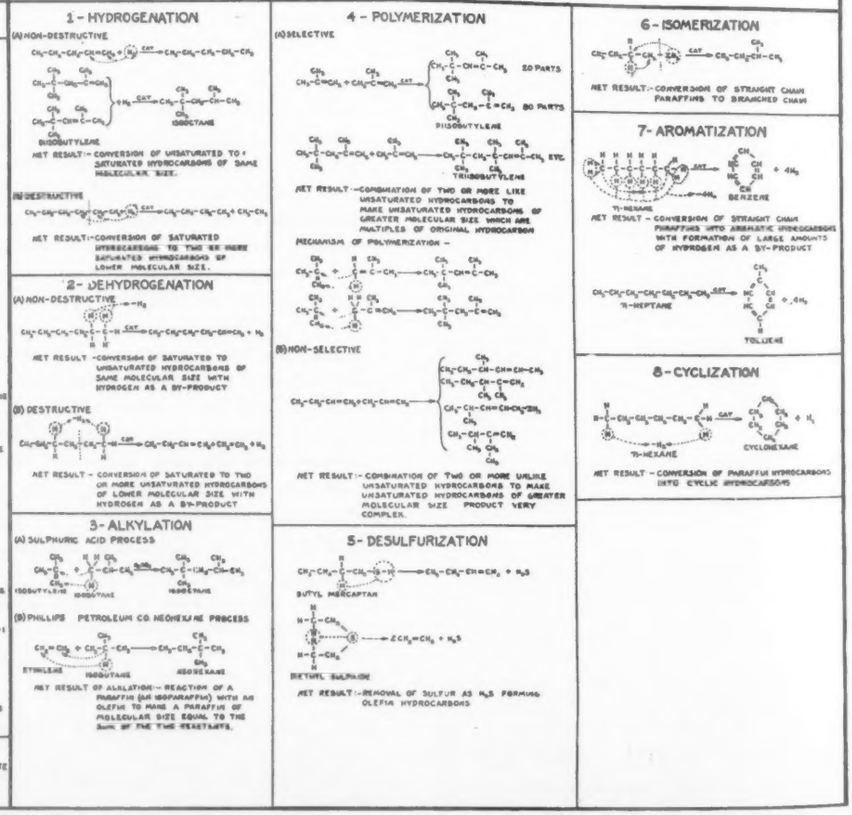
(Continued on Page 134)

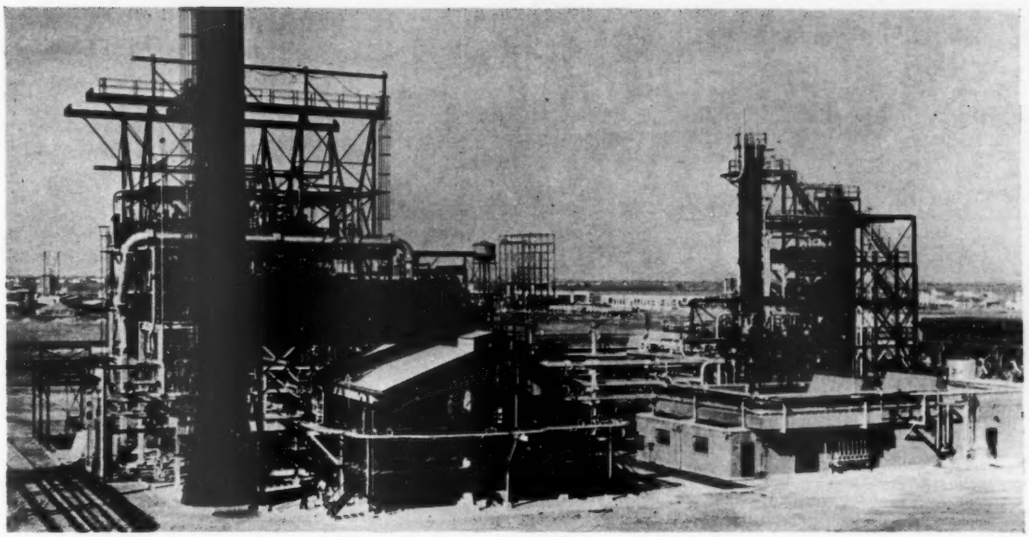
NOMENCLATURE OF PARAFFIN AND OLEFIN HYDROCARBONS *

FORMULA	GENERAL NAME	NAME IN SUBSTITUTION SYSTEM	NAME IN GENEVA SYSTEM
CH_4	METHANE	METHANE	METHANE
CH_3-CH_3	ETHANE	METHYL METHANE	ETHANE
$CH_3-CH_2-CH_3$	PROPANE	DIMETHYL METHANE	PROPANE
$CH_3-CH_2-CH_2-CH_3$	n-BUTANE	METHYL ETHYL METHANE	BUTANE
$CH_3-CH(CH_3)-CH_3$	ISOBUTANE	TRIMETHYL METHANE	2-METHYL PROPANE
$CH_3-CH_2-CH_2-CH_2-CH_3$	n-PENTANE	DIETHYL METHANE	PENTANE
$CH_3-CH_2-CH(CH_3)-CH_3$	ISOPENTANE	DIMETHYL ETHYL METHANE	2-METHYL BUTANE
$C(CH_3)_4$	NEOPENTANE	TETRAMETHYL METHANE	2,2-DIMETHYL PROPANE
$CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$	n-HEXANE	ETHYL PROPYL METHANE	HEXANE
$CH_3-CH_2-CH(CH_3)-CH_2-CH_3$	ISOHEXANE	DIMETHYL PROPYL METHANE	3-METHYL PENTANE
$CH_3-CH(CH_3)-CH_2-CH_2-CH_3$		METHYL DIETHYL METHANE	2-METHYL PENTANE
$CH_3-CH(CH_3)-CH(CH_3)-CH_3$		DIMETHYL ISOPROPYL METHANE	2,3-DIMETHYL BUTANE
$CH_3-C(CH_3)_2-CH_2-CH_3$	NEOHEXANE	TRIMETHYL ETHYL METHANE	2,2-DIMETHYL BUTANE
$CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3$	n-HEPTANE		HEPTANE
$CH_3-C(CH_3)_2-CH(CH_3)-CH_3$	TRIPTANE	TRIMETHYL ISOPROPYL METHANE	2,2,3-TRIMETHYL BUTANE
$CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3$	n-OCTANE		OCTANE
$CH_3-CH_2-C(CH_3)_2-CH(CH_3)-CH_3$		DIETHYL ISOPROPYL METHANE	3-METHYL, 3-ETHYL PENTANE
$CH_3-C(CH_3)_2-CH_2-CH(CH_3)-CH_3$	"ISOOCTANE"		2,2,4-TRIMETHYL PENTANE
$CH_3-(CH_2)_7-CH_3$	n-NONANE		NONANE
$CH_3-(CH_2)_8-CH_3$	n-DECANE		DECANE
$CH_2=CH_2$	ETHYLENE	ETHYLENE	ETHYLENE (ETHENE)
$CH_3-CH=CH_2$	PROPYLENE	METHYL ETHYLENE	PROPYLENE (PROPENE)
$CH_3-CH_2-CH=CH_2$	α BUTYLENE	ETHYL ETHYLENE	BUTENE-1
$CH_3-CH=CH-CH_3$	β BUTYLENE	SYM. DIMETHYL ETHYLENE	BUTENE-2
$CH_2=C(CH_3)_2$	ISOBUTYLENE	UNSYM. DIMETHYL ETHYLENE	2-METHYL PROPENE-1
$CH_2=C(CH_3)-C(CH_3)_3$	DIISOBUTYLENE		2,4,4-TRIMETHYL PENTENE-2
$CH_2=C(CH_3)-CH_2-C(CH_3)_3$			2,4,4-TRIMETHYL PENTENE-1
$CH_2=C=CH_2$	METHYL ALLENE		BUTADIENE-1,2
$CH_2=CH-CH=CH_2$			BUTADIENE-1,3
$CH_2=CH-CH=CH-CH_3$			PENTADIENE-1,3
$CH_2=C(CH_3)-CH=CH_2$	ISOPRENE		2-METHYL BUTADIENE-1,3

* DUE TO COMPLEXITY OF ORGANIC CHEMISTRY NOMENCLATURE THIS TABLE MUST NOT BE CONSIDERED COMPLETE

CHEMISTRY OF PETROLEUMIZATION - 1940


1 - HYDROGENATION
(A) NON-DESTRUCTIVE
DIISOBUTYLENE
NET RESULT:- CONVERSION OF UNSATURATED TO SATURATED HYDROCARBONS OF SAME MOLECULAR SIZE.
(B) DESTRUCTIVE
NET RESULT:-CONVERSION OF SATURATED HYDROCARBONS TO TWO OR MORE SATURATED HYDROCARBONS OF LOWER MOLECULAR SIZE.
2 - DEHYDROGENATION
(A) NON-DESTRUCTIVE
NET RESULT -CONVERSION OF SATURATED TO UNSATURATED HYDROCARBONS OF SAME MOLECULAR SIZE WITH HYDROGEN AS A BY-PRODUCT
(B) DESTRUCTIVE
NET RESULT - CONVERSION OF SATURATED TO TWO OR MORE UNSATURATED HYDROCARBONS OF LOWER MOLECULAR SIZE WITH HYDROGEN AS A BY-PRODUCT
3 - ALKYLATION
(A) SULPHURIC ACID PROCESS
ISOBUTYLENE
ISOBUTANE
ISOOCTANE
(B) PHILLIPS PETROLEUM CO. NEOHEXANE PROCESS
ETHYLENE
ISOBUTANE
NEOHEXANE
NET RESULT OF ALKILATION:- REACTION OF A PARAFFIN (OR ISOPARAFFIN) WITH AN OLEFIN TO MAKE A PARAFFIN OF MOLECULAR SIZE EQUAL TO THE SUM OF THE TWO REACTANTS.
4 - POLYMERIZATION
(A) SELECTIVE
20 PARTS
80 PARTS
DIISOBUTYLENE
TRIISOBUTYLENE
NET RESULT:-COMBINATION OF TWO OR MORE LIKE UNSATURATED HYDROCARBONS TO MAKE UNSATURATED HYDROCARBONS OF GREATER MOLECULAR SIZE WHICH ARE MULTIPLES OF ORIGINAL HYDROCARBON
MECHANISM OF POLYMERIZATION -
(B) NON-SELECTIVE
NET RESULT:- COMBINATION OF TWO OR MORE UNLIKE UNSATURATED HYDROCARBONS TO MAKE UNSATURATED HYDROCARBONS OF GREATER MOLECULAR SIZE PRODUCT VERY COMPLEX.
5 - DESULFURIZATION
BUTYL MERCAPTAN
METHYL SULPHIDE
NET RESULT:-REMOVAL OF SULFUR AS H_2S FORMING OLEFIN HYDROCARBONS
6 - ISOMERIZATION
NET RESULT:- CONVERSION OF STRAIGHT CHAIN PARAFFINS TO BRANCHED CHAIN
7 - AROMATIZATION
n-HEXANE
BENZENE
NET RESULT - CONVERSION OF STRAIGHT CHAIN PARAFFINS INTO AROMATIC HYDROCARBONS WITH FORMATION OF LARGE AMOUNTS OF HYDROGEN AS A BY-PRODUCT
n-HEPTANE
TOLUENE
8 - CYCLIZATION
n-HEXANE
CYCLOHEXANE
NET RESULT - CONVERSION OF PARAFFIN HYDROCARBONS INTO CYCLIC HYDROCARBONS



Hydroforming unit in the Pan American Refining Corp. plant at Texas City, Tex.

First Commercial Hydroforming Plant Now in Operation

By D. J. SMITH and L. W. MOORE
Vice President Technical Assistant
Pan American Refining Corp.

WHILE the use of catalysts to promote chemical reactions dates back almost to the beginning of chemical knowledge, it is only within the past 5 years that catalytic petroleum-refining processes have found a wide commercial application in the United States. The most recent addition to this growing family is the hydroforming process, so named because it is a catalytic process for the "reforming" or converting of low-octane to high-octane gasolines at high temperatures in the presence of hydrogen gas.

The first commercial hydroforming plant was placed in operation recently at the Texas City, Tex., refinery of the Pan American Refining Corp. It is capable of reforming about 7,500 bbl. per day of 40-45-octane heavy naphtha to an 80 per cent yield of about 80 A.S.T.M. octane gasoline. The unit is designed to take all of the low-octane heavy naphtha produced from the two largest cracking units in the world (capacity about 40,000 bbl. per stream-day each) in addition to small amounts of heavy naphtha produced from miscellaneous crude-topping operations. The product from the Texas City plant will be blended into the principal grades of gasoline marketed by the American Oil Co.

Nature of Process

Since the hydroforming process involves carrying on a reaction in the presence of hydrogen, it might appear that this process is closely related to the hydrogenation process. This is not the case, however. Hydrogenation reactions involve the addition of hydrogen to hydrocarbon molecules, whereas the net effect of the hydroforming process is to dehydrogenate, that is, to take hydrogen away from hydrocarbon molecules. Part of the hydrogen thus produced is recirculated with the fresh feed to control the rate and extent of the dehydrogenation reaction. The most important property of the hydroforming catalyst is that it causes ring closure to occur along with dehydrogenation, so that the product contains a high percentage of aromatic hydrocarbons and only a small quantity of aliphatic unsaturates. Thus the product is unusually stable, and, in the case of the Texas City plant, is blended directly into finished gasoline.

While the design of the Texas City plant presented some difficult engineering problems, the process flow is relatively simple. The fresh feed, consisting of a 40-45-octane heavy naphtha, is preheated by heat exchange with hot reaction products and sent to a combination naphtha and recycle-gas preheater furnace. A hydrogen-rich recycle-gas stream from a gas separator is also preheated by heat exchange and sent through a separate coil in the preheater furnace which heats it to a high temperature. The two streams issuing from the furnace are then mixed and sent to the catalytic reactors which are under substantial pressure.

The hot reaction products leaving the catalytic reactors are partially cooled by heat exchange with cold naphtha feed and other products. They are then cooled to normal temperature and sent to a gas separator. Part of the gas from the separator is used as recycle gas and the remainder goes to the refinery fuel system. The liquid from the gas separator is pumped to a stabilizer tower where the last traces of gas are removed, and then to a rerun tower where a small amount of heavy polymer is removed. The product from the rerun tower is sent to storage, from which it is blended into finished gasoline.

During the course of the hydroforming reaction, a small amount of coke is deposited on the catalyst. As the amount of coke deposited increases, the activity of the catalyst gradually decreases, so that it is necessary to remove a catalytic reactor from service periodically and burn the coke off in order to restore catalyst activity.

Burning is done by recirculating flue gas through the reactors, the rate of burning being controlled by adding small amounts of air to the flue gas. Reactivation is carried out at an elevated pressure and at carefully controlled temperatures.

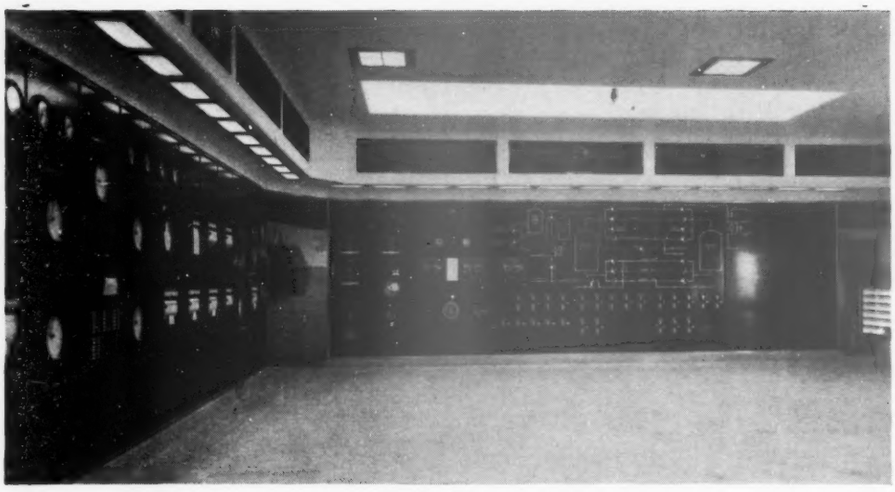
Engineering Features

The Texas City plant has two large catalytic reactors, which are in service alternately—one being on stream and one off for reactivation at all times.

In designing the plant, care was taken to avoid thermal cracking of the naphtha before it contacts with the catalyst. Thermal cracking of the naphtha is undesirable because it decreases both the yield and octane and results in excessive coke deposition.

The design of the recycle-gas-stream and reactivation systems was a complicated one from an economic standpoint, because, for any given octane level, coke deposition is a function of the amount of recycle gas and the hydrogen concentration of the recycle gas, and consequently the size of the reaction system is dependent on the size of the recycle-gas system. This problem, in addition to many others in connection with the design, was made more difficult by the fact that the process development did not go through the usual stages of pilot plant to semicommercial to full-scale design. Practically all of the data used in the design had to be obtained from laboratory operation.

Operation of the reactivation system is entirely automatic and is controlled through a time-cycle



Control board used in the manufacture of hydroform gasoline

mechanism. Because of the relatively long reactivation and on-stream periods, the time-cycle mechanism is used also to change conditions in fractionating towers to take care of variations in product quality with change in catalyst activity.

The hydroforming process, as installed, is a development of the research organizations of several companies, including, primarily, the M. W. Kellogg Co., Standard Oil Development Co. and Standard Oil Co. (Indiana). The design of the Texas City plant was carried out by engineers of the M. W. Kellogg Co. in collaboration with engineers of the Pan American Refining Corp. and Standard Oil Co. (Indiana). Construction work was done by the M. W. Kellogg Co. The unit is being operated under patent license from the Standard Catalytic Co., which has important patent rights for this and related processes.

Yields and Product Quality

Although the hydroforming process is sufficiently flexible to produce gasoline over a wide range of octane numbers up to 90 A.S.T.M., the conditions selected for the design of the Texas City plant were those which produce 80 per cent of an 80 A.S.T.M. octane number gasoline. Typical charge and product inspections are as follows:

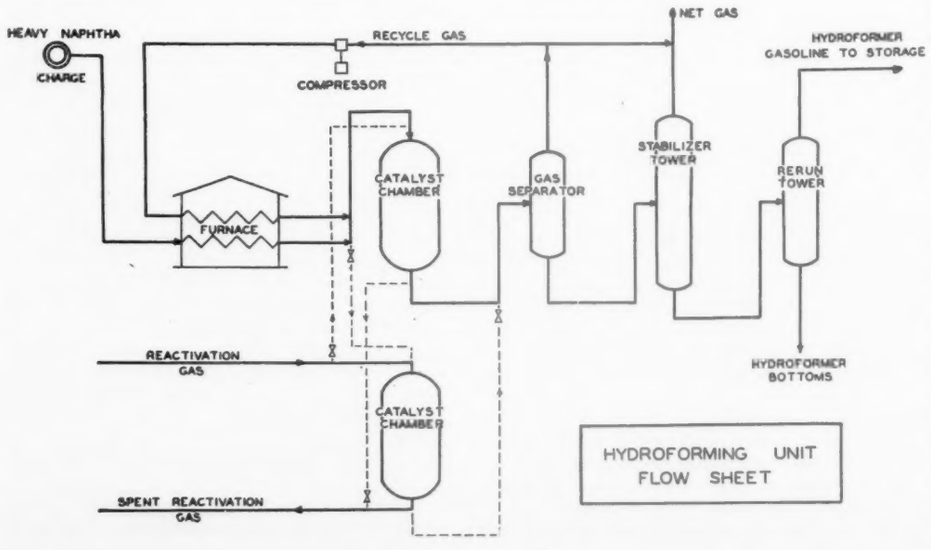
	Charge	Products
Gravity, °A.P.I.	51.4	51.3
Octane number, A.S.T.M.	47.2	77.0
Reid vapor pressure	0.4	8.2
Initial boiling point	222	99
10 per cent	250	174
50 per cent	292	270
90 per cent	367	339
Maximum °F.	436	368

The above inspections show substantial increases in octane number and volatility with a slight decrease in gravity, thus indicating the presence of aromatics in the product. Analysis shows the product to contain 40 to 50 per cent of aromatics. From 15 to 20 per cent of the aromatics present are toluene, most of the remainder being xylenes and higher aromatics.

While the most important application of the hydroforming process undoubtedly will be to produce high-octane motor-car gasolines, there are other features of the process which are of importance to petroleum refiners. The process is sufficiently flexible so that either straightrun or cracked gasolines may be reformed, and, in general, the product requires no treatment to render it suitable for the market.

Source of Toluene

By changing operating conditions, the hydroforming process can produce a high-grade aviation gasoline, or can be modified to produce a product having upwards of 80 per cent aromatics. This latter feature of the process is particularly important from a military standpoint, as it affords a means for substantially augmenting toluene production in this country. The total production of toluene in the United States was 20,000,000 gal. in 1939, but the toluene content of the product from the Texas City plant alone is equivalent to an annual production of 5,000,000 gal., or about 25 per cent of the total United States toluene production in the year 1939.

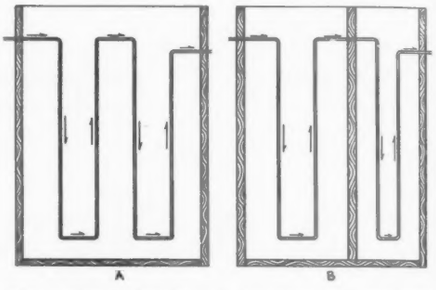


Partition in Water Tank Lowers Oil Temperature

A. C. KITTELL, president of the Aerex Co., which company is operating a 100-bbl. skimming plant at Bloomfield, N. M., cites the practical advantages of a partition wall to divide the water-cooled vapor lines in a conventional condenser box. He has used the idea for several years and reports temperatures from 20° to 30° lower on the stream coming from the partitioned box compared with that coming from a box of the same size and using the same quantity of water but not supplied with the partition wall.

Shown here is a cross-sectional drawing of the two types of condenser boxes. The one on the left and marked as *A* is typical of the conventional open-type box so generally used in the refining industry. The drawing on the right and marked *B* shows almost a duplication of the first drawing, the only difference being the partition through the center of the second box.

The conventional practice used to cool the submerged condenser tubes in the box at the left is to pump cold water into the bottom of the box



Cross-sectional drawing of two types of condenser boxes. Partition extending from the bottom and almost to the top of the box at right reduces the oil-outlet temperature for the same quantity of cooling water used in both

at one end and allow the overflow to spill into a leadoff line near the top of the box at the opposite end. In this type of installation the hot-vapor lines enter the box near the water outlet and leave the box at a point near the water inlet. The conventional "counter-flow" of the liquids permit maximum exchange of heat.

In operating the box at the right the same general practices and arrangement of tubes is used except that the cool water coming to the system does not mix with the entire mass of water present in the box but remains on one side of the partition wall until the volume of the water pumped into the tank is sufficient to cause it to overflow into the second compartment.

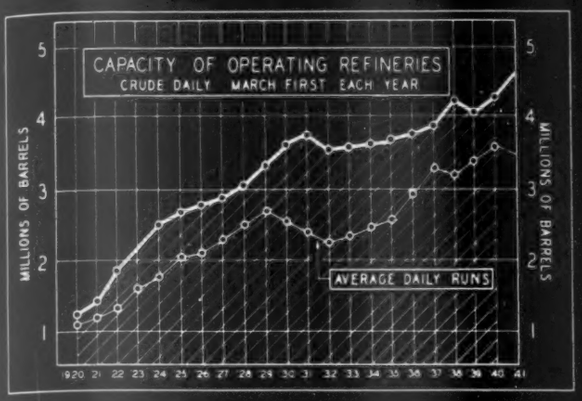
With the partition in use, the countercurrent exchange of heat is fully utilized and in addition, the circulation of the water in the two compartments appears to be more thorough than when using only the one large compartment.

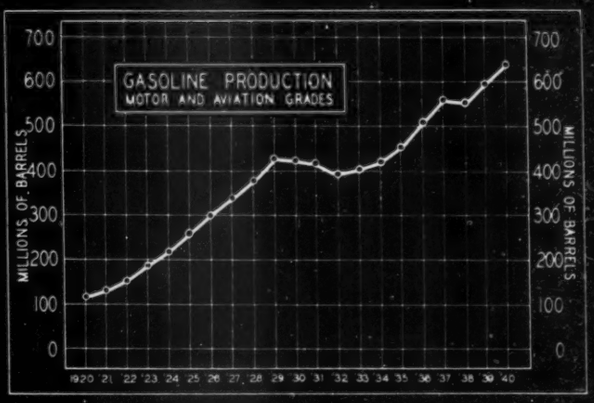
●

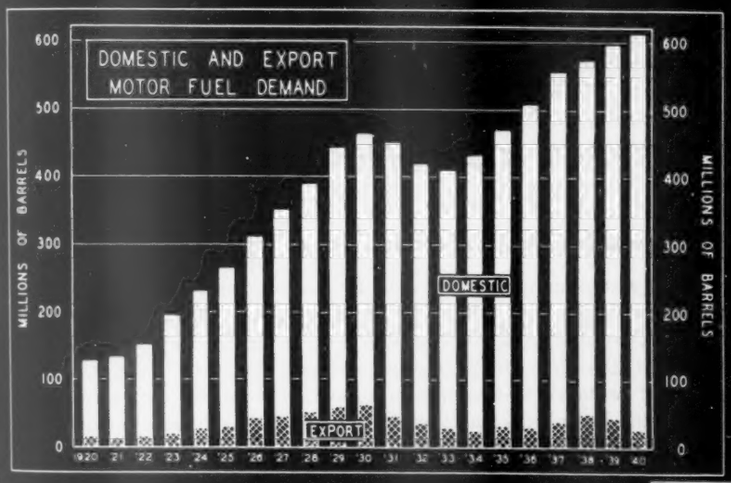
Alberta Sets Octane Ratings

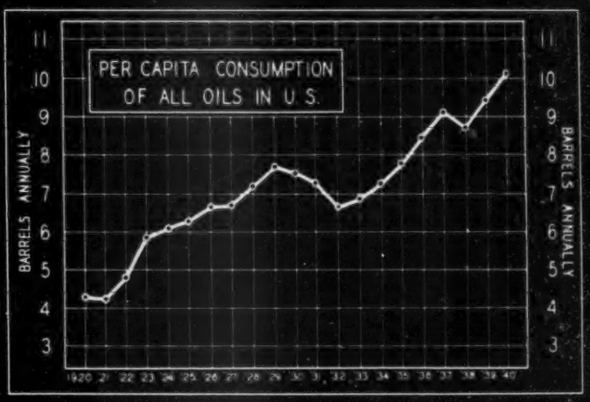
EDMONTON, Alta.—The provincial government has established specifications for gasoline sold in Alberta which fix both maximum and minimum octane ratings. Two grades of gasoline are provided: premium gasoline, with a maximum octane number of 78 and minimum of 75, and regular gasoline, with a maximum of 70 and a minimum of 66. These maximum ratings have been set in an effort to conserve for war-aviation purposes tetraethyl lead which is used in aviation gasoline and which must all be imported from the United States.

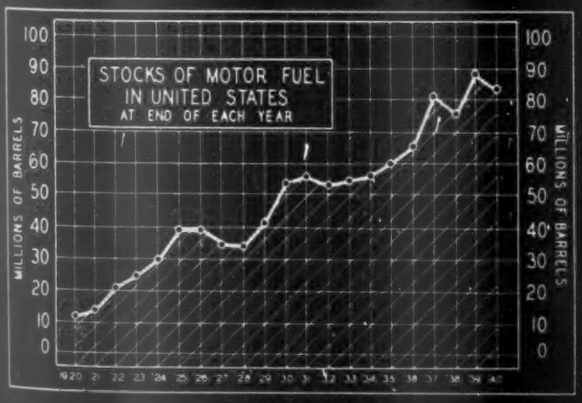
TRENDS in Refining

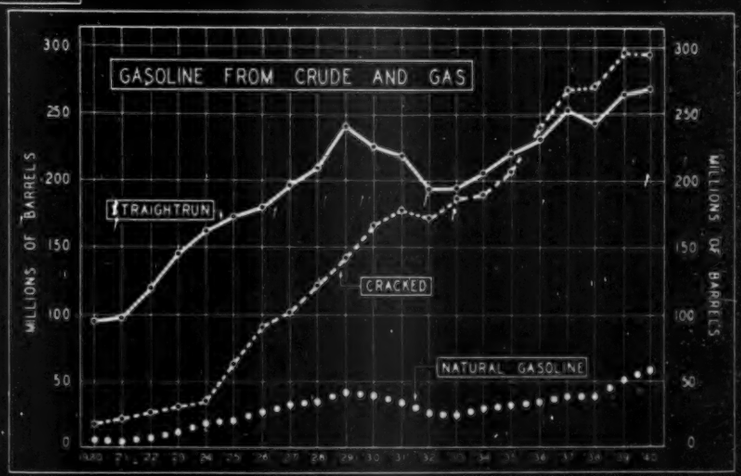








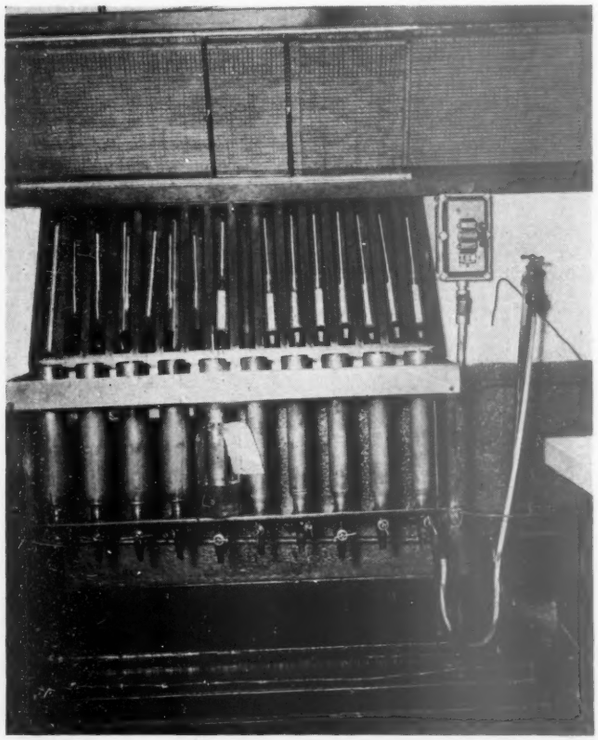




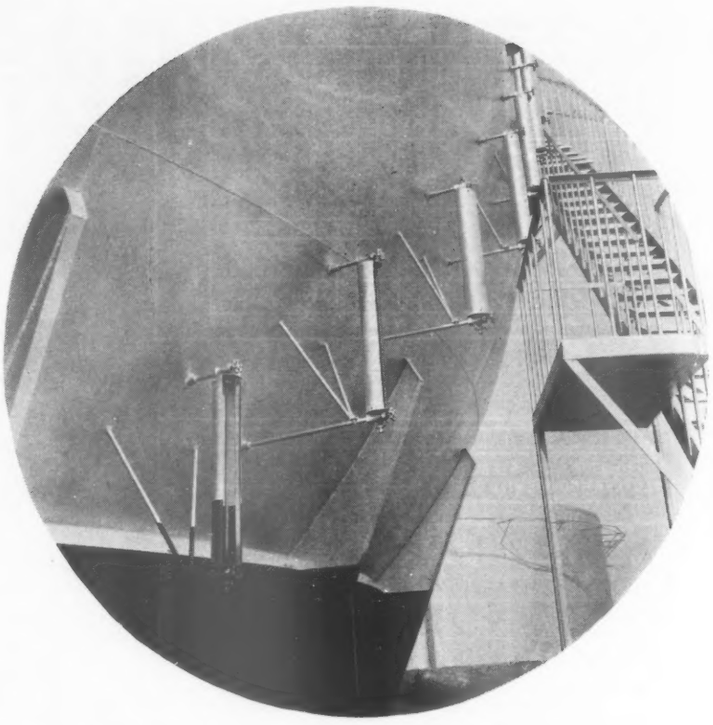
REFINERY GADGETS

Slide and Rack Speed Up Making Gravity Corrections

One company has decreased the time for making oil-gravity determinations by concentrating in one location a large correction chart equipped with a slide and track, a hydrometer rack, and a battery of drain tubes. Four of these tubes are equipped with electric heating coils. In the picture may



be seen the overhead correction chart permanently mounted in a frame. The frame is constructed to provide tracks over which an etched-glass panel can be drawn to any part of the chart. The lines on the glass panel permit the operator to concentrate his attention more easily on the temperature and hydrometer readings which he has taken and to correlate these with the corrected gravity reading desired from the chart. The picture also shows the relative location of the hydrometer grooves and tubes. The four tubes at the left may be electrically heated. All of the tubes drain into the pan below. Also note the conveniently located ledge along the front of the tubes on which samples may be set preparatory to testing. This assembly enables the operator to handle all of the normal samples brought to the laboratory and readings can be taken in much less time than normally.

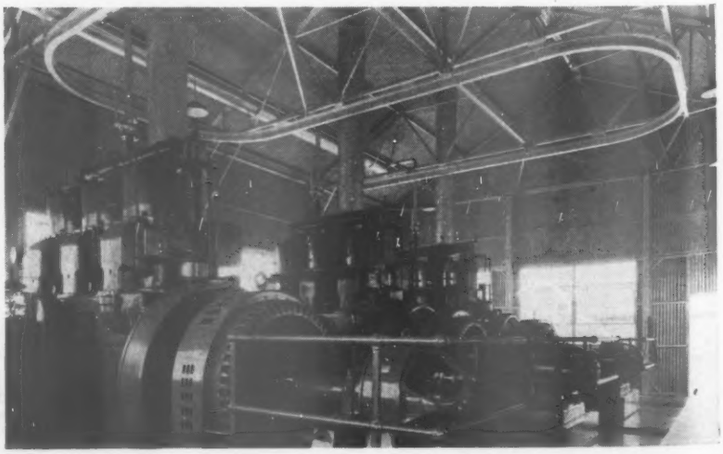


Provide Background for Gage Glasses

Protection was given the gage glasses installed on a pressure tank and their utility was improved by supporting curved and aluminum-painted plates as background for each glass. The accompanying picture clearly shows the manner in which each shield is held in place between the two iron disks. An ordinary rule is suspended inside the shield to permit gaging. Obviously the problem of supplying a gage glass for a spherical tank is a more difficult one than supplying one for a vertical tank. Here the gage glasses have been installed in line with the steps and they overlap to provide full range of level readings.

S-Shaped I-Beam Used as Crane Track

In plants where engine repairs must be made quickly and safely as an economy measure, the most useful tool is the movable crane. Here is shown an installation of engines with a track provided overhead for the lifting and moving of any part of two engines. The track is simply a bent section of ordinary I-beam and is supported from the roof frame. By bending the beam into the letter *S* it is possible to make the track continuous and to serve the front, side, and rear parts of two engines.



SUPERIOR QUALITY

in every detail

1 **GLASS AFFORDED EVERY PROTECTION.** Frame completely contains the glass so that no part is exposed. Weight of frame entirely supported by liquid chamber gland . . . not by glass.

2 **UNIFORM GASKET PRESSURE ASSURED** by accurate finishing of the retaining surfaces to very close tolerances.

3 **EQUAL RESILIENCE ON BOTH SIDES OF GLASS** due to interchangeable gaskets which also eliminate possibility of improper reassembly in field.

4 Spacing band centers glass and prevents contact with metal.

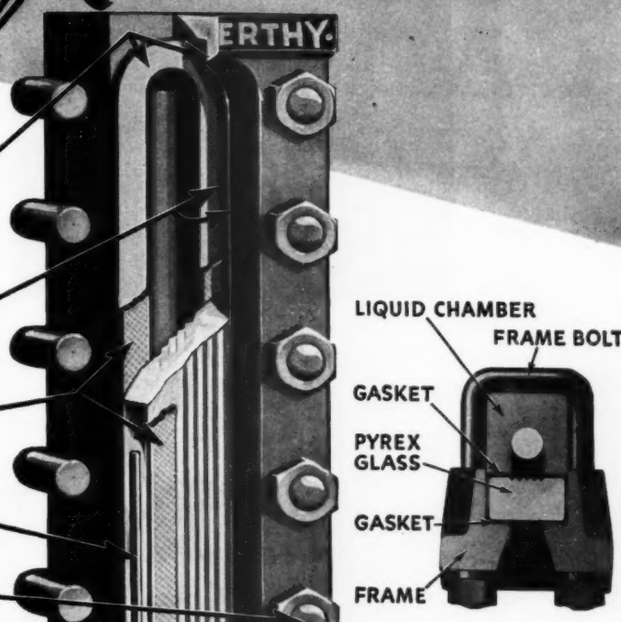
5 **PERFECT GASKET JOINTS WITH MINIMUM BOLT TENSION** because misalignment of parts is impossible, which also eliminates frequent cause of glass breakage.

6 **DISTORTION PREVENTED** by reinforcing beam and scientific distribution of metal in frame. (Distortion causes excessive strains in glass and results in breakage.)

7 **GASKET BLOW-OUTS PREVENTED** by full metal backing of entire surface and periphery of both gaskets.

8 **RIGIDITY AND PERFECT ALIGNMENT** are assured by machining liquid chamber from a solid block of temperature resisting steel heat treated to prevent warping.

9 **PYREX GLASS** is used exclusively because of its greater strength and resistance to thermal shock and erosion. Exhaustive comparative tests have proven conclusively that Pyrex glass is the highest grade obtainable for the service.



EMPTY SPACE SHOWS **WHITE**

LIQUID SHOWS **BLACK**

PENBERTHY DROP FORGED STEEL REFLEX LIQUID LEVEL GAGES

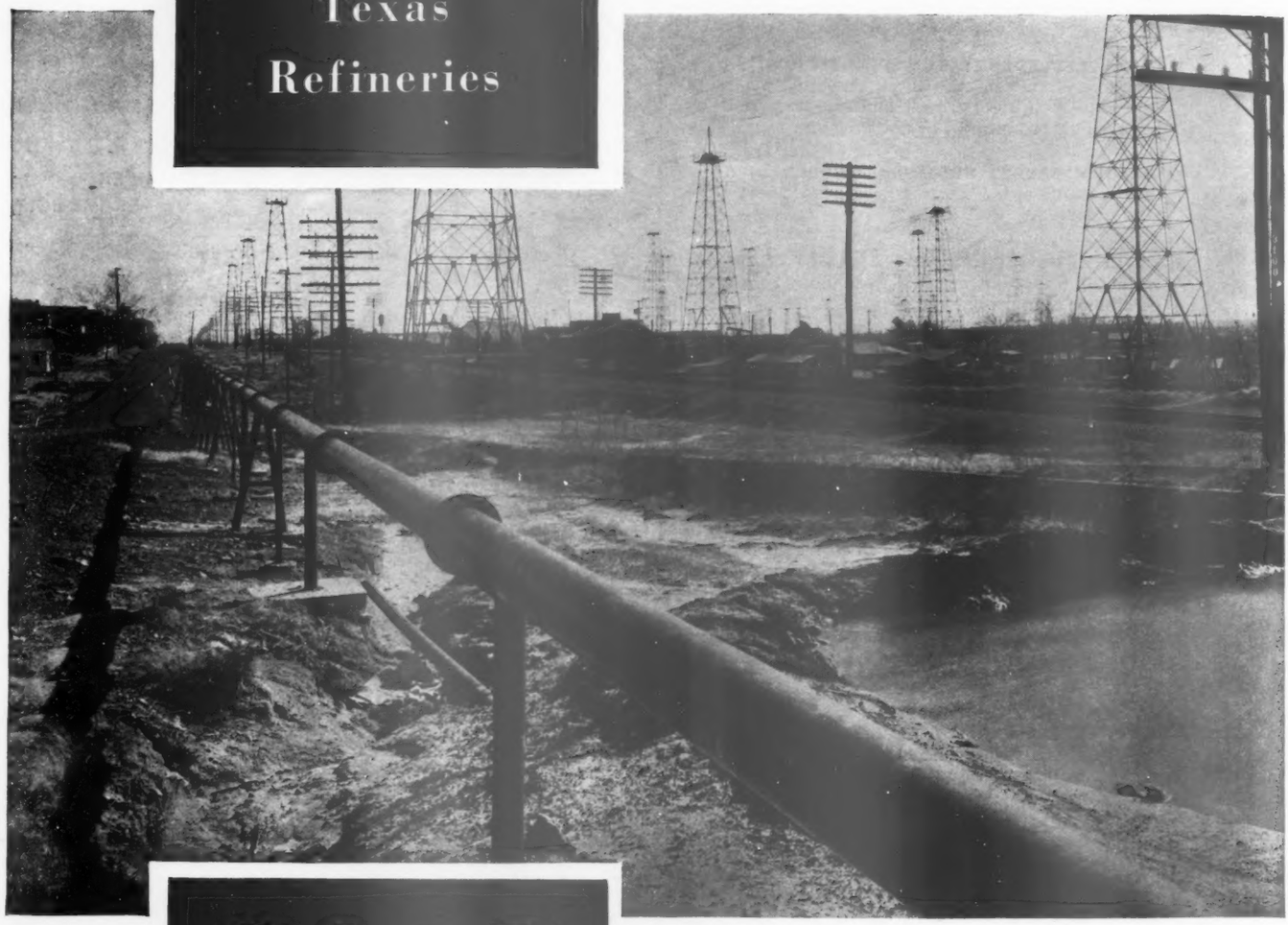
THESE Penberthy Reflex Gages are made in whatever lengths required and for various liquids; they conform with A.P.I.-A.S.M.E. requirements and are recommended for pressures up to 3000 lb. p.s.i. at 100° F. and 1000 lb. at 1000° F. Write for Catalog 34-A for complete information.

PENBERTHY PRODUCTS

PENBERTHY INJECTOR COMPANY

Manufacturers of Quality Products Since 1886 • DETROIT [illegible] Windsor, Ont.

Cast Iron Pipe Fresh Water Line Serving Texas Refineries

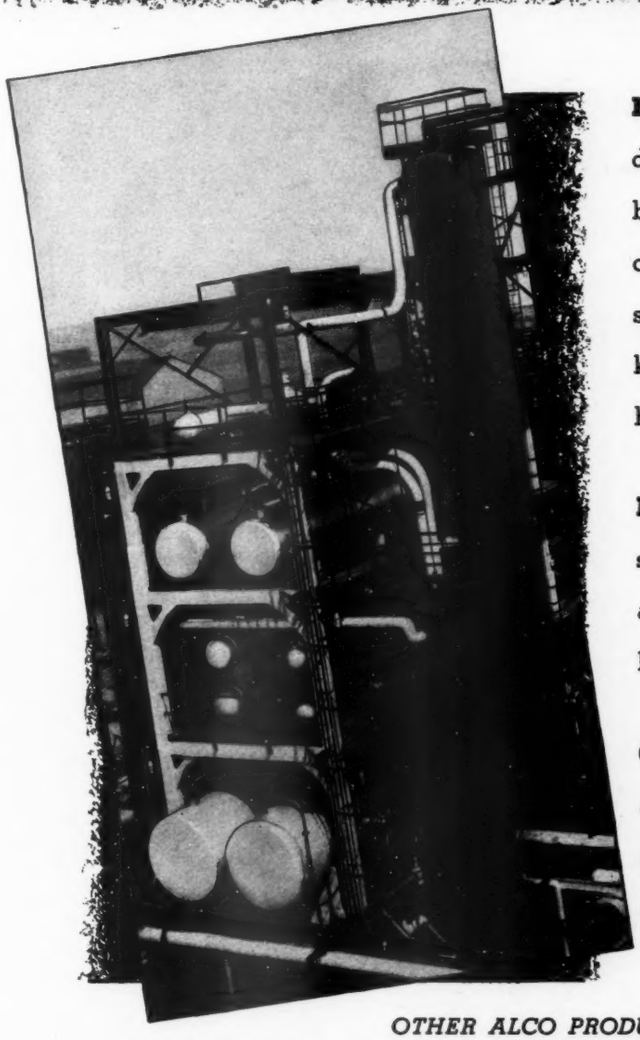


CAST IRON PIPE

For Longer Life and Economy

When you put in or replace a conduit which must withstand internal or external corrosion, or both, remember that cast iron pipe gives you *maximum resistance to corrosion per dollar of cost.* Figured by duration of service the *ultimate cost* of cast iron pipe is so low as to be a real factor in maintenance economy. Cast iron pipe is obtainable in bell-and-spigot, plain and threaded ends and flanged types, or with stuffing-box mechanical joints, in diameters from 1¼ to 84 inches. Address inquiries to The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

ALCO VAPOR HEAT EXCHANGERS CONDENSERS



Experienced Thermal Engineers determine required surface on the basis of heat transfer test data obtained from actual installations supplemented by a thorough knowledge of the fundamentals of heat transfer.

Designed by a staff fully conversant with refinery layout problems and the proper construction of heat transfer equipment.

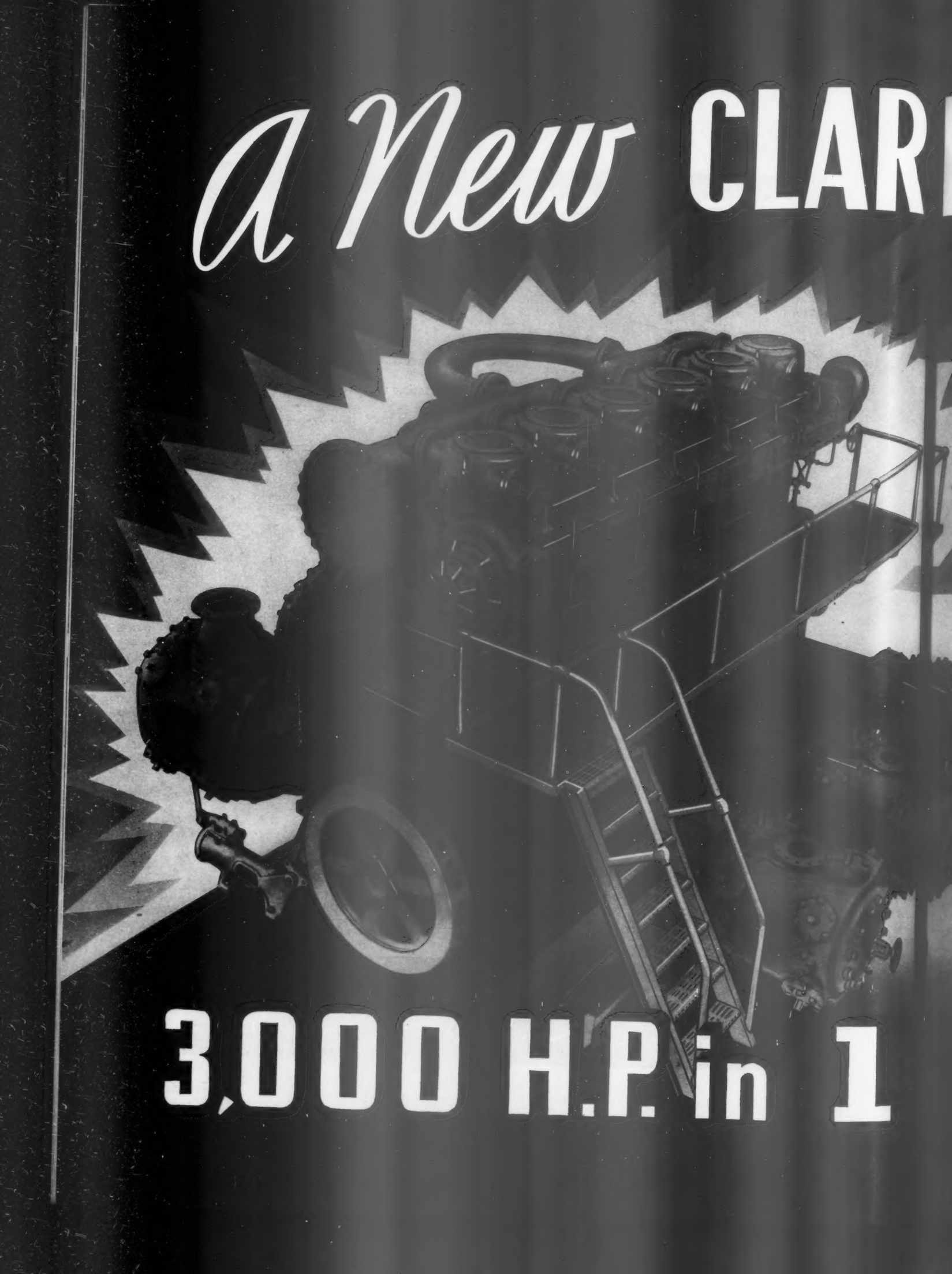
Constructed by trained mechanics in a plant fully equipped with all facilities necessary to do a first class job.

OTHER ALCO PRODUCTS

HEAT EXCHANGERS • PRESSURE VESSELS • PRE-FABRICATED PIPING
BOILER FEED WATER HEATERS • FABRICATED PLATE EQUIPMENT • ELECTRIC WELDED STEEL PIPE

AMERICAN LOCOMOTIVE COMPANY
ALCO PRODUCTS DIVISION
30 CHURCH ST., NEW YORK, N. Y. DUNKIRK, N. Y.

a New CLAR



3,000 H.P. in 1

RK Development

CLARK *STEAM-DRIVEN* "ANGLE" COMPRESSOR

Sizes up to 4,000 H. P.

In response to a request by the Union Oil Company of California, for a large-capacity CLARK "Angle" Compressor with steam drive — Clark recently designed and built two 3,000 H. P. "Angle" units — one of which is shown at left.

These two units, equal to a battery of ten 6-cylinder, 600 H. P. CLARK gas-driven "Angles", — are being installed in Union's refinery at Oleum, California, along with three 8-cylinder CLARK gas-driven "Angles" equipped with our new supercharged power cylinders and developing 1,000 H. P. per unit.

The new CLARK Steam-Driven "Angle" is equipped with Unaflow steam cylinders, noted for economical operation. The particular features of this compressor are small floor space requirements, low foundation and building costs, economical steam rates, flexibility, and minimum maintenance costs due to the smallness of the parts. Tests indicate this unit will set new records in its field for low first cost, low maintenance, and low operating cost per horsepower. It is available in sizes from 600 to 4,000 H. P. Get in touch with our nearest office for complete information.

CLARK BROS. CO., INC. . . OLEAN, NEW YORK. U.S.A.

Export Offices: 30 Rockefeller Plaza, New York. Domestic Sales Offices and Warehouses: Tulsa, Okla.; Houston, Texas; Chicago, Ill.; Boston, Mass. (131 Clarendon St.) West Coast Offices: Smith-Booth-Usher Co., Los Angeles, Cal. Foreign Offices: 72 Turnmill St., E. C. 1, London; 4 Str. General Poetas, Bucharest, Roumania

Affiliated Companies

Dresser Manufacturing Company, Bradford, Pa.
Bryant Heater Company, Cleveland, Ohio
Pacific Pump Works, Huntington Park, Calif.
Van der Horst Corporation of America.
Porous Chrome Hardening for engine parts.

Front View — 3,000 H. P. Steam Driven "Angle"

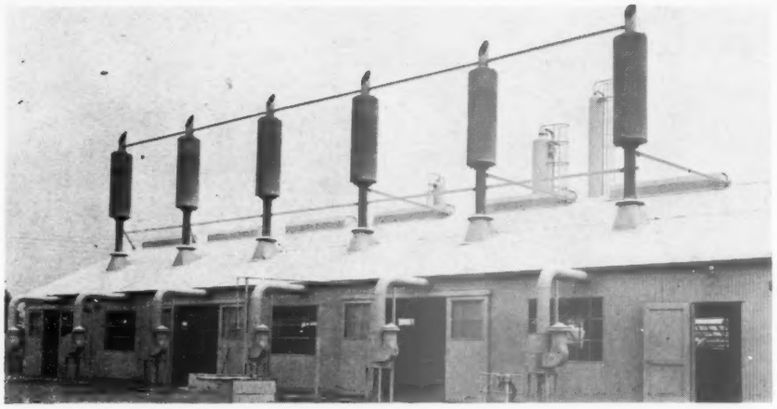
Side View — 3,000 H. P. Steam Driven "Angle"

CLARK

L COMPRESSOR UNIT

REFINERY GADGETS

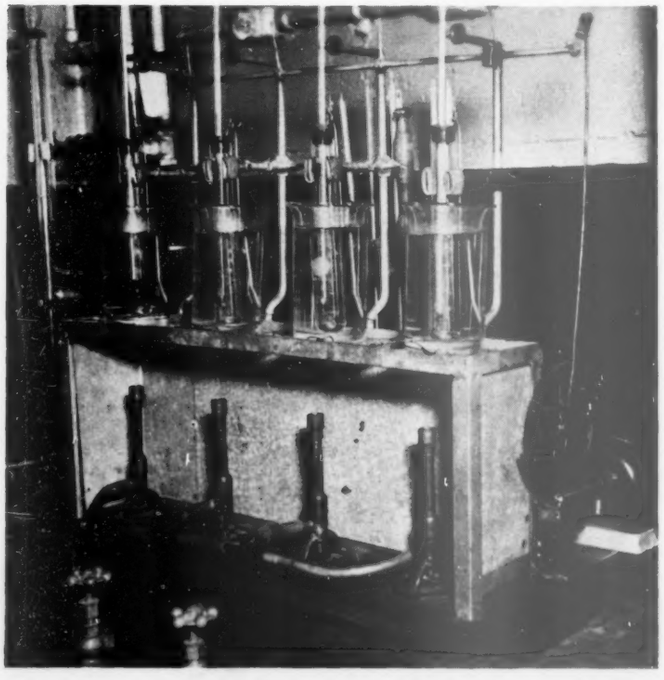
Bracing Exhaust Mufflers

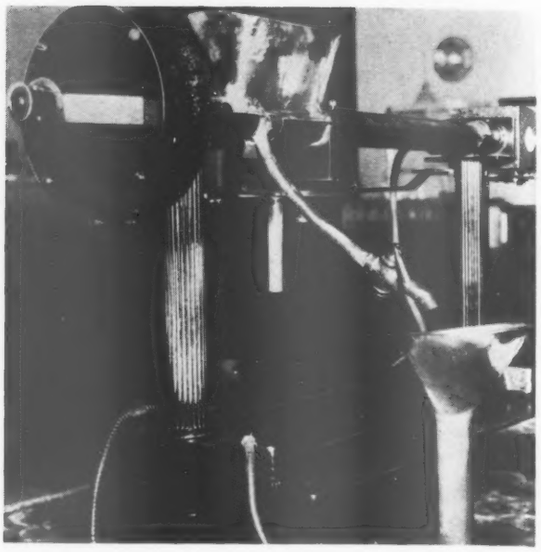


Providing added safety and relieving the mufflers of strain, a series of six mufflers are tied together at two points and laterally supported by rods securely fastened into the roof ridge of the compressor building. As other compressors are added inside the building, it is an easy matter to continue on the lines of supports. It will be noted also that supports extend in two directions.

Four-Place Aniline-Point Apparatus With Power Stirrer

This multiple-unit aniline-point apparatus permits one operator to do the work of four provided with only single-place units. The stainless-alloy-wire stirring mechanism is driven by a small electric motor through a worm and gear. The aniline-oil mixture and the water bath are stirred simultaneously. The reciprocating motion of the wire stirring device is provided by the arm which reaches from the electrically driven gear wheel to the assembly of arms over the test tubes and bottles. A light motor directly connected through a gear box drives the long vertical arm. Sufficient strength has been designed into the upper shaft to hold it horizontal while the arm tends to rotate it through an angle of about 30°. The extent of the rotation can be adjusted within practicable limits.



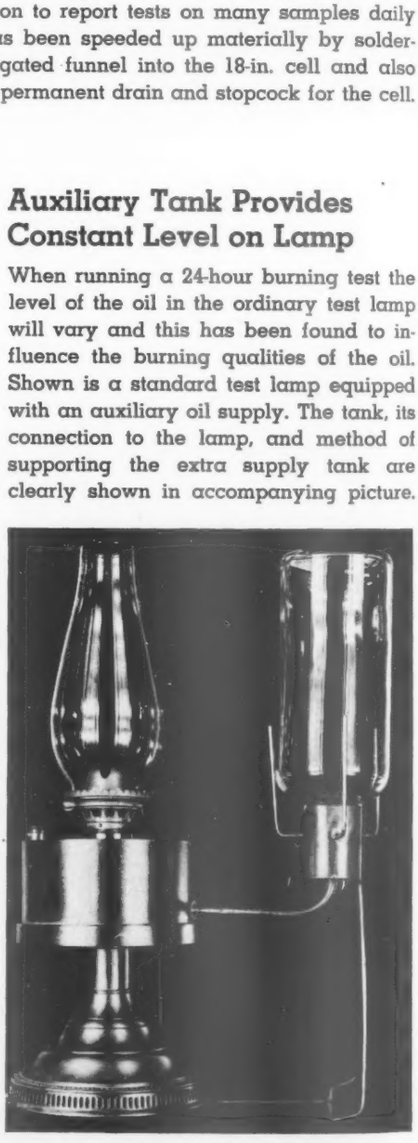


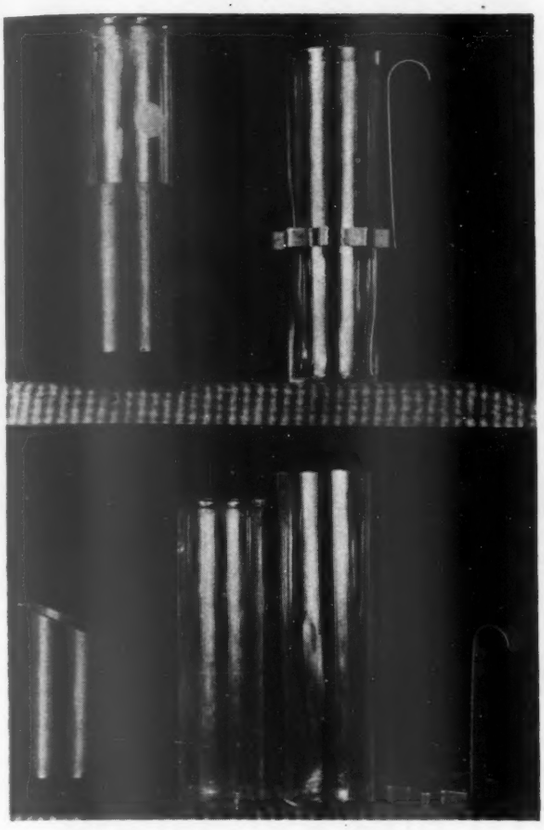
Speed Up Lovibond Color Testing With Funnel and Drain

In a large laboratory where the Lovibond colorimeter is called upon to report tests on many samples daily the work has been speeded up materially by soldering an elongated funnel into the 18-in. cell and also providing a permanent drain and stopcock for the cell.

Auxiliary Tank Provides Constant Level on Lamp

When running a 24-hour burning test the level of the oil in the ordinary test lamp will vary and this has been found to influence the burning qualities of the oil. Shown is a standard test lamp equipped with an auxiliary oil supply. The tank, its connection to the lamp, and method of supporting the extra supply tank are clearly shown in accompanying picture.





Pour-Test Determination Expedited By Clip and Level Gage

In order to most accurately and conveniently pour the correct quantity of oil into the test jar preparatory for making a pour-point determination one laboratory is equipped with specially designed jar holders. These are of predetermined height. After the glass jar is in place inside the holder the oil sample is poured to the edge of the metal receptacle. Obviously, the inside surfaces of the metal receptacle and the base of the glass jar must be clean to allow the jar to set squarely. The corrugated metal clip which is also shown in the picture has been found to be very convenient in handling the jar before and after cooling. Its corrugated ring is sufficiently flexible to hold any glass test jar securely while any transfers are made.

Sample Drum Conveniently Placed

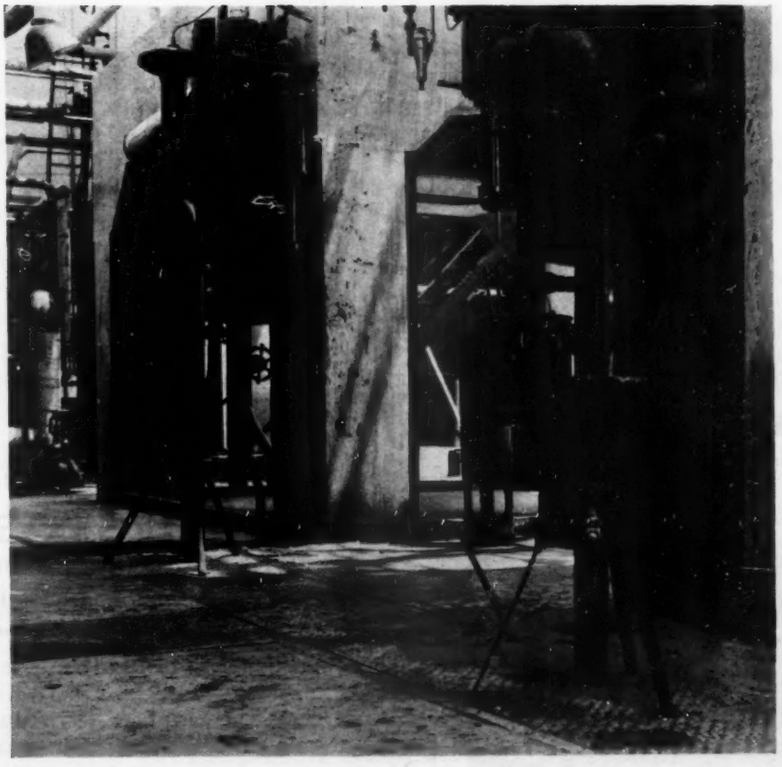
Approximating the conditions in the rundown tank, oil samples may be taken at the control house. This has been accomplished at the refinery as shown here. Short lengths of 12-in. pipe have been fitted with legs and welded closed at both ends except for fittings. These serve as reservoirs. One reservoir is placed alongside the pipe which returns to the top of the tower a portion of the condensed overhead. A small bleed line from the pipe, equipped with a valve, permits the operator to collect a running sample of the production and to do this without losing light ends. The resulting sample is comparable to the accumulated production in the main rundown tank for the period in which the sample is collected for inspection.

Skid Tank of Butane Into Position Without Truck

Where deliveries are made by truck, a current practice is to supply trailers which remain at the point of loading or unloading while the truck itself is handling other loads. A recent modification of this idea was adopted in a plant

where deliveries of butane are made. The butane tank is mounted on a strong, steel skid and this tank is skidded off the bed of the truck as a new supply is brought to the plant. This method of handling eliminates delays in unloading and reduces handling losses by evaporation which are dangerous.

REFINERY GADGETS

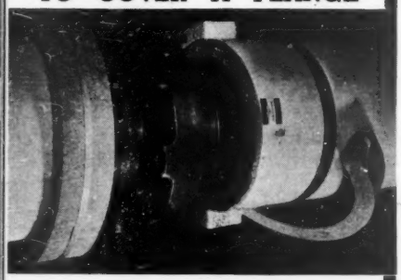


UNIBESTOS

BLOCKS — SHEETS and SECTIONAL PIPE COVERING

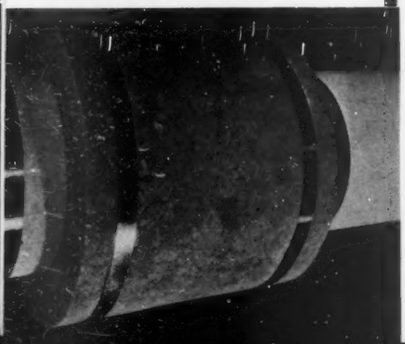
The Heat Insulation that offers a lot of *Plus* Values for OIL REFINERIES

A Story in Pictures: **"HOW TO COVER A FLANGE"**



1. **(Above): Fitting two short collars over ends of pipe covering on each side of flange.**

2. **(Above): Placing a long collar (also cut from standard UNIBESTOS) over the two short collars.**
3. **(Below): The complete covering. Smooth, neat, efficient, and readily removable.**



ALL-ROUND STRENGTH AND DURABILITY

The hard, smooth outer surface is backed up by a resilient, fibrous, felted interior. Takes ordinary hard knocks without denting. Unaffected by vibration. Even when soaked, moisture can be steamed off repeatedly without damaging structure. No sagging. Ideal for outdoor or underground mains. No shrinkage nuisance.

Plus **UNEQUALED APPLICATION CONVENIENCE.** Saws or cuts clean and sharp with ordinary tools. Easy to strip off layers to fit unions, flanges, etc. Joints pull up tight without cementing. Double layers with broken joints not necessary. Surface takes good paint finish—additional covering often eliminated. Clean to handle. Light in weight.

Plus **CONVENIENCE IN REMOVAL AND RE-APPLICATION.** This one feature has made UNIBESTOS the preferred insulation in numerous refineries. Almost 100% salvageable, time after time.

Plus **PERMANENTLY LOW THERMAL CONDUCTIVITY.** UNIBESTOS has higher thermal efficiency than the most commonly used insulations and ability to resist all usual causes of deterioration.

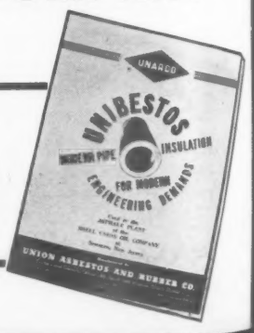
Plus **REASONABLE COST.** Cost, including installation, often runs less. Offered in two standard grades—one for 750°F. limit, the other for 1200°F. Single layer, sectional insulation for pipe diameters up to 36", thicknesses up to 5". Sheets up to 36" x 36" x 5". We will be glad to send you samples, specifications and prices.

UNION ASBESTOS and RUBBER COMPANY

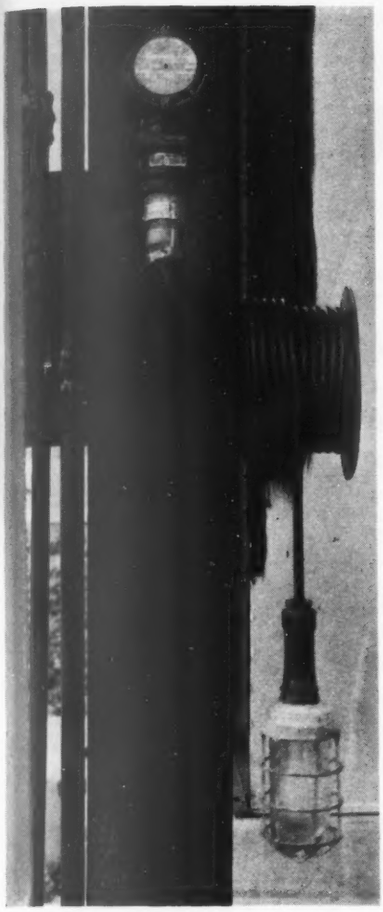
1819 South 54th Avenue, Cicero, Ill.

Contractor-Distributors in Principal Industrial Centers

AN INTERESTING BULLETIN presenting a picture story of the installation of UNIBESTOS on tanks and cargo lines at the Shell Union Asphalt plant in Seewaren, N. J., is yours on request. Numerous useful ideas on insulation application. Write for a copy.

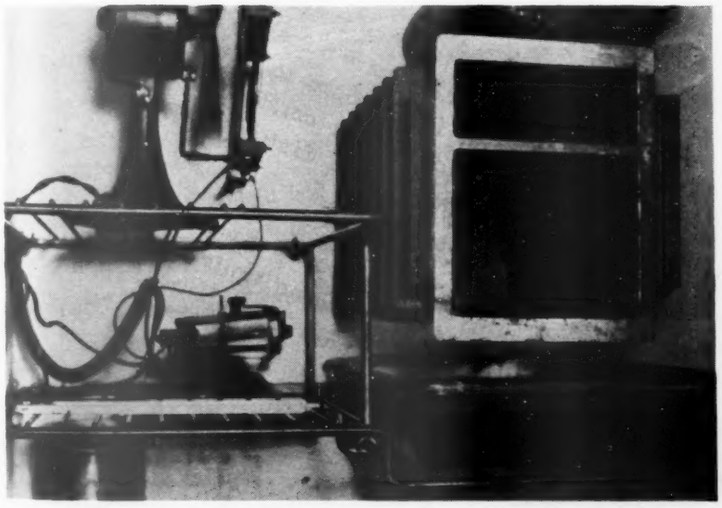


REFINERY GADGETS



Convenient Reel for Trouble Light

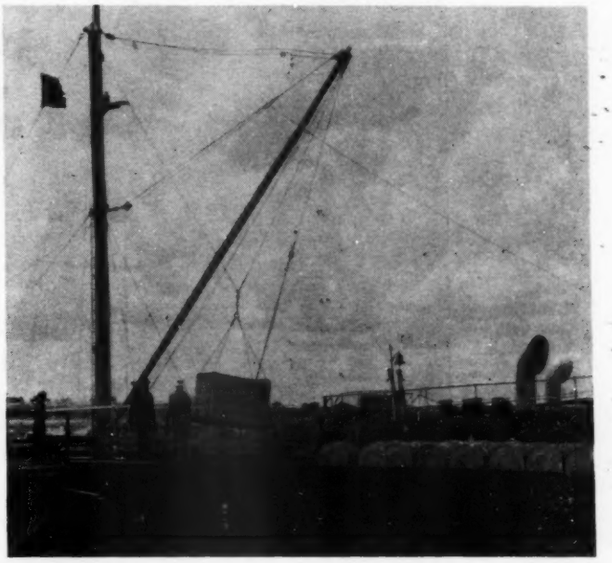
The quick repair of a motor, pump, or the replacement of packing in a leaking valve might be necessary at any time of the day or night. To handle the job an electric light is essential. One plant has provided such lights with 100 ft. of heavy electric cord with each light. These lights have been placed throughout the plant wherever their use might occur. Safety and economy are provided in the reel upon which the cord is wound by letting out only the required length.



Device Maintains Air Bath Temperature of 77° F.

To insure accuracy of testing asphalt samples one refiner preconditions his samples by storing them in an air bath maintained at exactly 77° F. or the temperature at which the test must be made. To provide volume and economy, the laboratory personnel converted an old household electric refrigerator to this service. The mechanism inside the box consists essentially of the conventional expansion coils to provide refrigeration, an electric circulating fan, an electric heating coil and a sensitive, ether-filled thermostatic control. The resistant wire heating element is immediately in front of the fan. When either the heater or the cooling mechanism is on the fan also runs to insure circulation and close control limits.

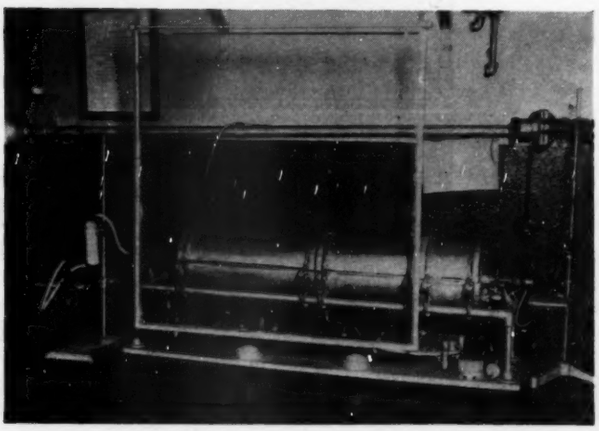
Assemble Case Goods on Platform For Loading in Hold of Ship

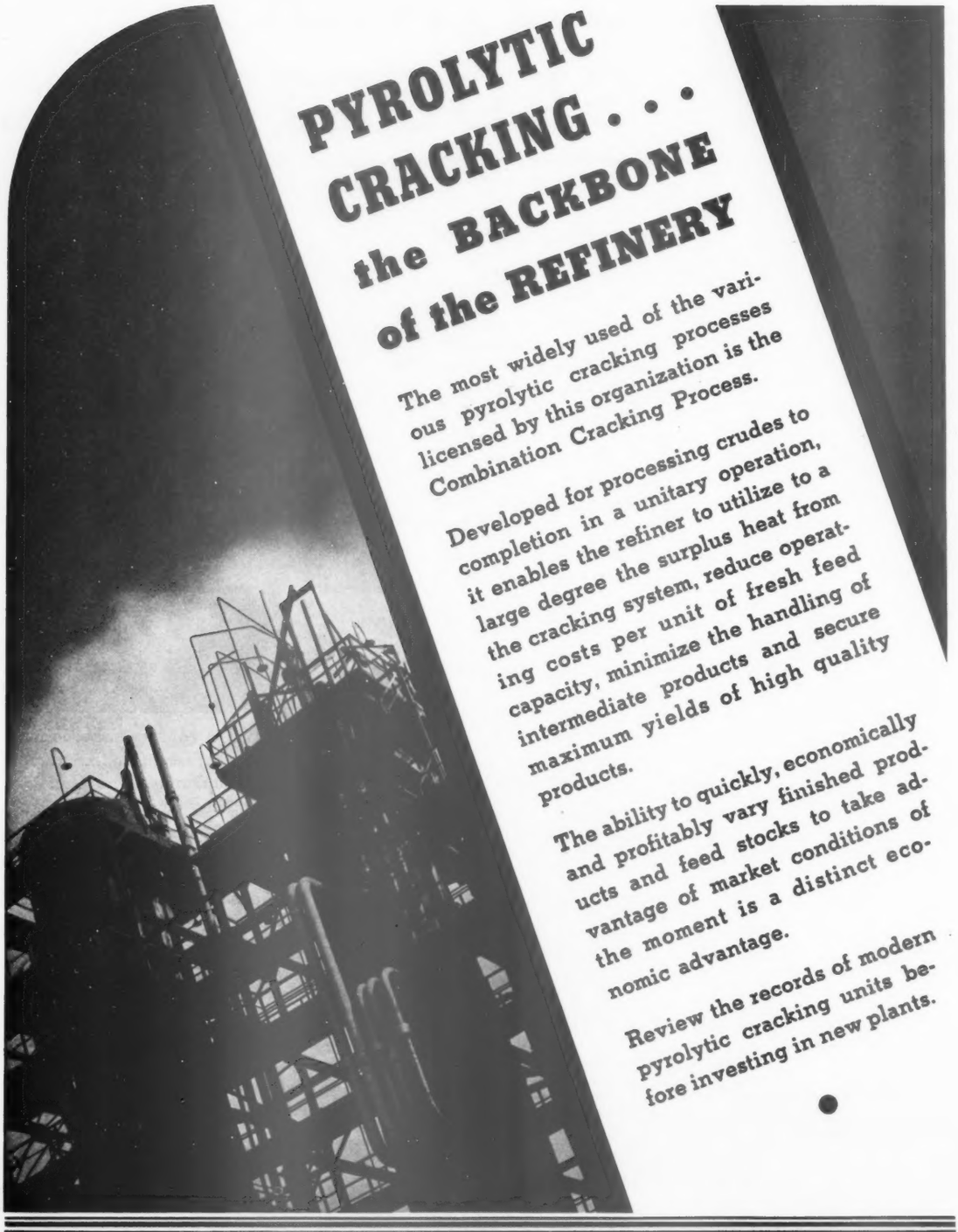


Cans of oil packed in cardboard boxes for export or coastwise shipment now represent an important item in the total transportation of lubricants. One Gulf Coast refiner has speeded up the loading time by piling 48 cases together on a wooden platform which may be suspended on iron cables. These cables pass through an iron ring and as the loaded platform is delivered to the dock by a truck, the platform and cases are easily picked up and swung into the hold.

Glass Shield at Combustion Apparatus

This safety screen was made from shatterproof windshield glass and permits the laboratory operator to view the progress of the carbon and hydrogen combustion without using goggles. It is suspended in front of the apparatus, the glass being cemented into the edges of a light steel frame. Use of this type of screen offers maximum eye protection and vision.





PYROLYTIC CRACKING . . . the BACKBONE of the REFINERY

The most widely used of the various pyrolytic cracking processes licensed by this organization is the Combination Cracking Process.

Developed for processing crudes to completion in a unitary operation, it enables the refiner to utilize to a large degree the surplus heat from the cracking system, reduce operating costs per unit of fresh feed capacity, minimize the handling of intermediate products and secure maximum yields of high quality products.

The ability to quickly, economically and profitably vary finished products and feed stocks to take advantage of market conditions of the moment is a distinct economic advantage.

Review the records of modern pyrolytic cracking units before investing in new plants.

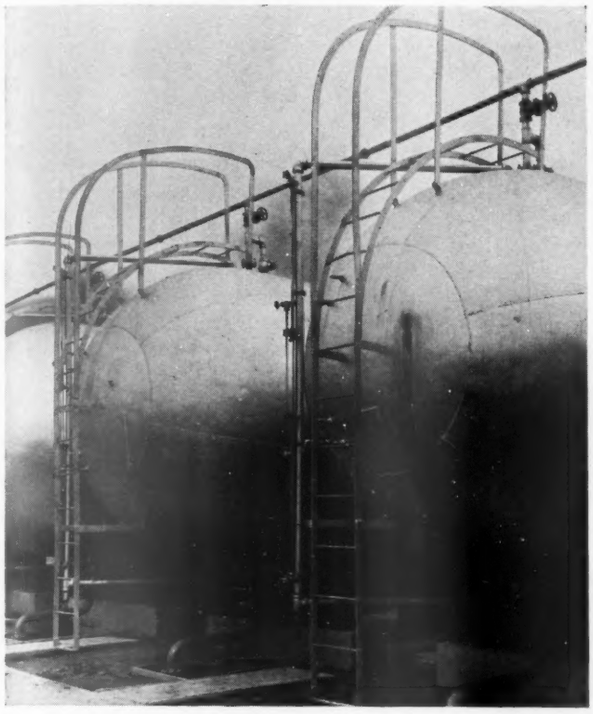
GASOLINE PRODUCTS COMPANY, INC.

26 Journal Square • Jersey City, New Jersey

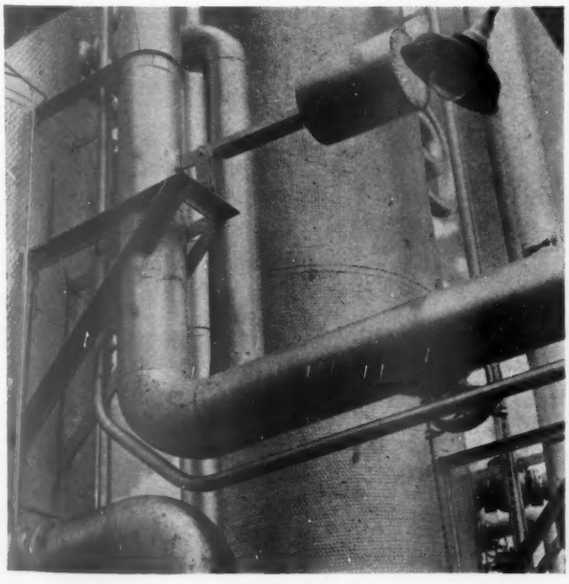
LICENSES granted under United States and Foreign Patents for: Cross, de Florez, Holmes-Manley, Tube and Tank Cracking Processes, Uni-Coil Injection Process and Combination Cracking Units
Licensing Agents: THE M. W. KELLOGG CO., Jersey City, New Jersey, or its *European Representative:* COMPAGNIE TECHNIQUE des PETROLES, 134 Boulevard Haussmann, Paris, France

REFINERY GADGETS

Gaging Horizontal Tanks

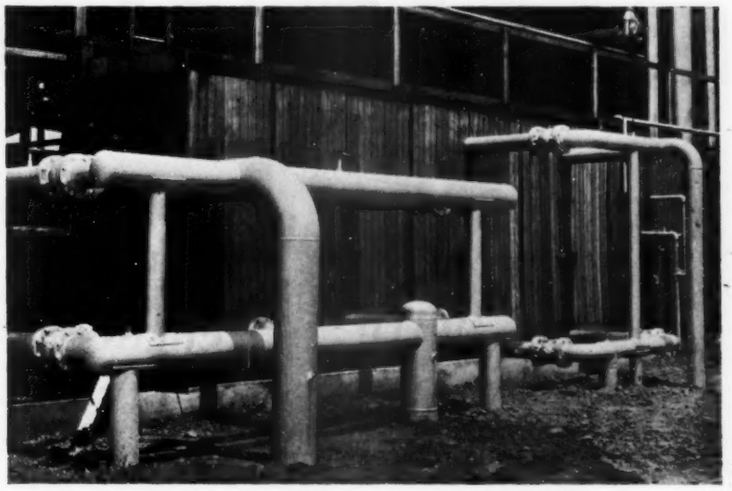


Getting on top of horizontal tanks has often been hazardous. One company has solved this problem at one of its plants by bending and welding strap iron to take the shape of the tank head and thereby providing a ladder and guard rail. The assembled unit is bolted in place to tank lugs.

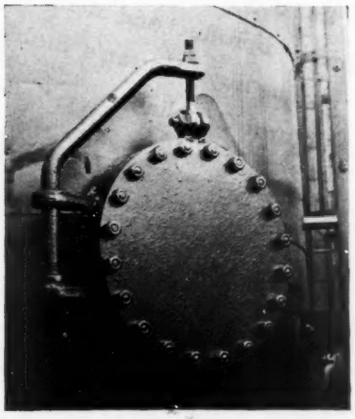


Positive Pipe Supports

Providing positive and yet reasonably flexible support to water lines serving a water-cooling tower is achieved in a Gulf Coast plant by resting the pipe on saddles which in turn are solidly welded and supported by pipe anchored in the ground. The practice of supporting one series of pipes on a lower series is also shown in the accompanying photograph.



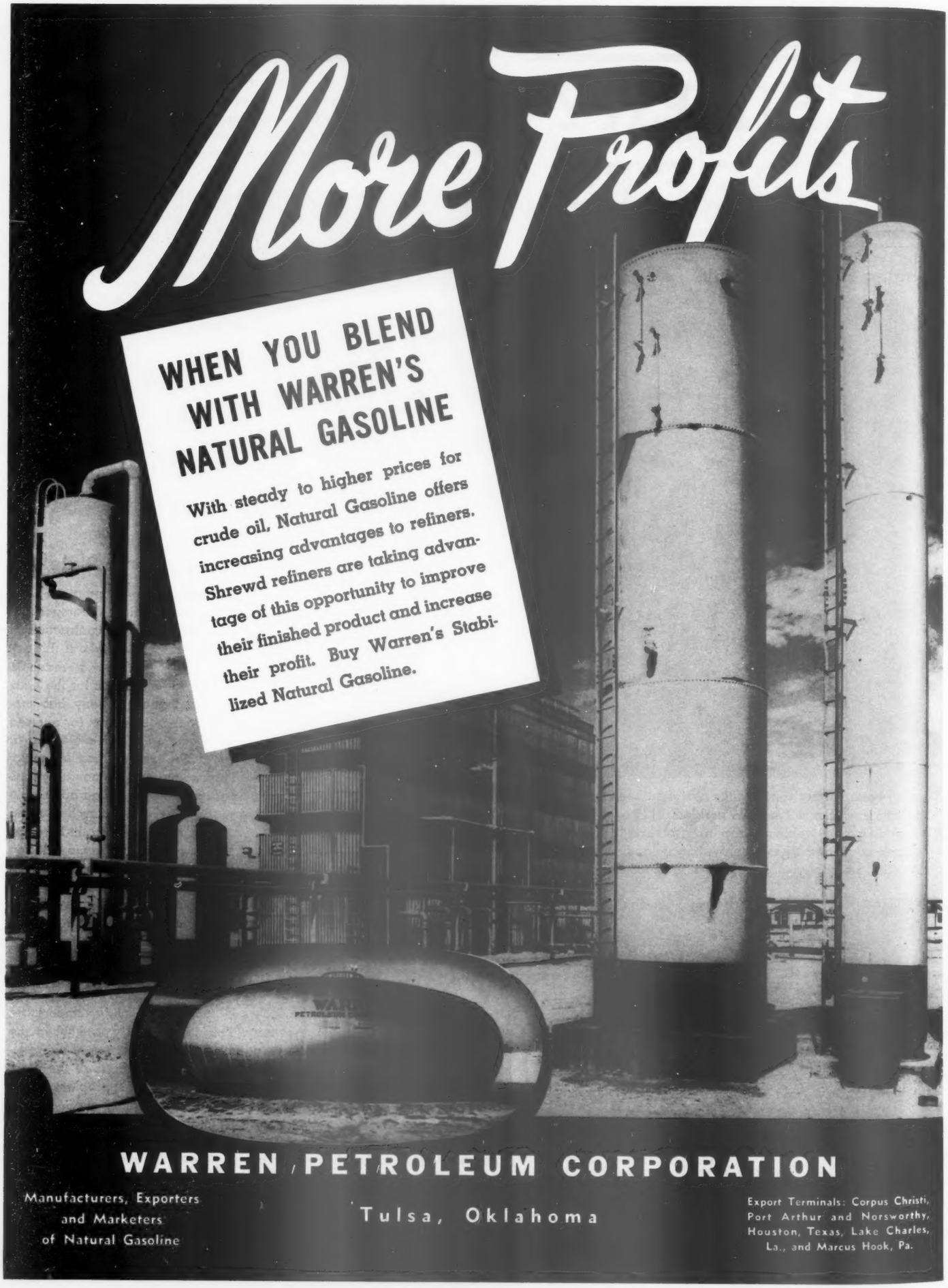
Adjustable Swing Provided for Manhole Plate



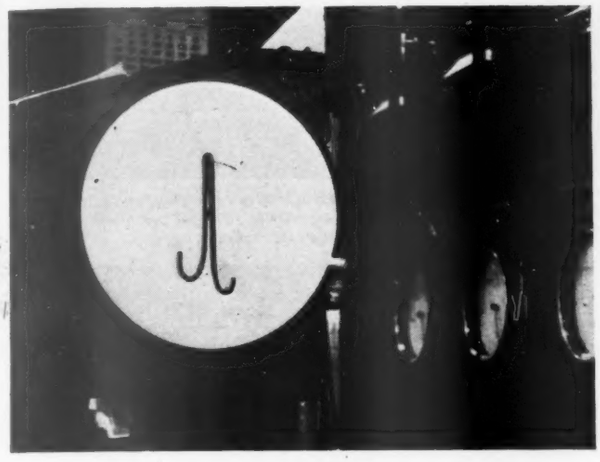
Differences in temperature and the corresponding differences in the expansion and contraction of dissimilar metals make it difficult to readily replace a manhole plate if the clearance for the bolts is small. One company has provided a simple means for altering the elevation of the plate and at the same time has provided maximum safety in its removal by supporting the plate on an adjustable swing. The plate can be turned out of position with little effort after the nuts are removed and can be brought back into position with similar ease. Another feature of the installation is the ease with which the cover can be moved completely out of the working space needed by the operator while he may be making repairs inside the tank or working from outside the tank.

Flexible Support Provided by Counterweight

Supporting long, vertical pipes, which are subjected to wide temperature changes, sometimes calls for ingenuity. This is especially true when the lack of room or the time for replacement does not permit the use of a sweeping, curved, and more flexible pipe section than can be made at the plant from standard straight pipe and fittings. The solution to this problem on the part of one plant is shown here. The vertical pipe is simply supported by the counterweight which passes over a fulcrum supported rigidly by a bracket which in turn is welded to the tower. The size of the counterweight must be determined by the weight of the pipe to be supported and provision must be made for the liquid or vapor in the pipe during operation. This installation takes care of a relatively small line and the counterweight was made simply by pouring a predetermined quantity of cement into an 18-in. section of 12-in. pipe and choosing a balancing point on the angle-iron lever to give the counterweight the effect of having many times its actual weight. The weight to be supplied may then be easily calculated.

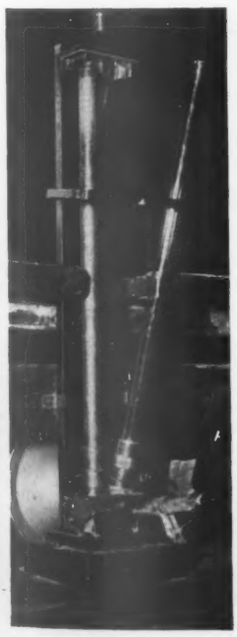

More Profits
WHEN YOU BLEND WITH WARREN'S NATURAL GASOLINE
With steady to higher prices for crude oil, Natural Gasoline offers increasing advantages to refiners. Shrewd refiners are taking advantage of this opportunity to improve their finished product and increase their profit. Buy Warren's Stabilized Natural Gasoline.
WARREN PETROLEUM CORPORATION
Manufacturers, Exporters and Marketers of Natural Gasoline
Tulsa, Oklahoma
Export Terminals: Corpus Christi, Port Arthur and Norsworthy, Houston, Texas, Lake Charles, La., and Marcus Hook, Pa.

REFINERY GADGETS



Handy Mounting for Daily Charts

Retention of the daily charts in chronological order, ready for instant reference, is obtained by one stillman's ingenuity. A long nail, driven in the end of the desk, provides a hanger for the charts, while a piece of welding rod, bent into the shape of an ornate script letter *M* fits over the nail and supports the charts, preventing the curling and bending which characterizes charts. The narrow midsection of the holder springs on over the nail, maintaining its grip at about its center, while the spread ends afford adequate support to the file of charts without offering any unsafe projection.



Simple Attachment Reduces Breakage Of Saybolt Tubes

A ring of light scrap iron permanently supported in position about two-thirds up the height of the Saybolt chromometer keeps the removable cell from falling when it is removed for cleaning or even if the cell should slip out of the clip while in use. It also holds the cell in a convenient position for pouring the oil sample into the tube. The cell can be readily removed if this becomes necessary by simply lifting the unit up through the metal band. An area of more than 12 sq. in. is left inside the band through which the tube may be drawn.

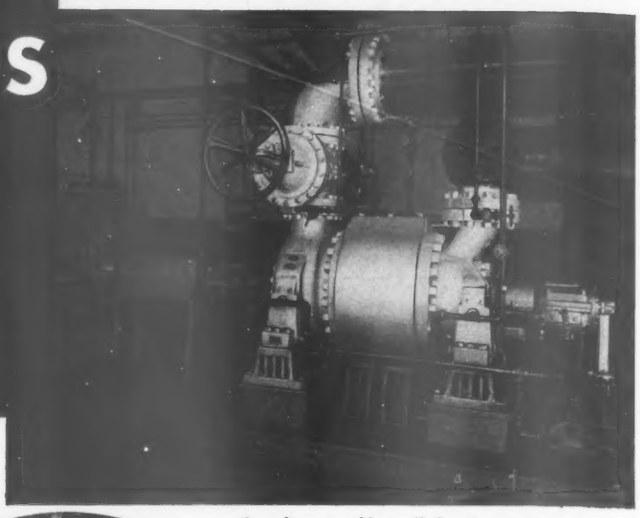
Sulfur Dispenser for Doctor Test Promotes Accuracy

A glass rod slipped through a glass tube, each securely cemented into a cork, provides the principal part of a device for measuring out 20 to 25 mg. of sulfur for making a doctor test. The procedure for the test requires this quantity of sulfur to be measured. To weigh out each quantity of sulfur would require much more time. Also, the quantity is measured with surprising accuracy. In use, the end of the assembly is pushed into the body of sulfur and is then withdrawn. A pellet of sulfur forms inside the tube. This is ejected by the rod. When not in use the inner glass rod is held in a raised position by a spring which may be seen in the picture. The height of the rod is gaged by the wire clip which is threaded through the upper cork and which slides past a peg in the lower cork. Obviously, as the spring is squeezed the inner glass rod forces out the sulfur pellet, and as the pressure is released the spring allows the rod to rise inside the tube to a height determined by length of the clip.

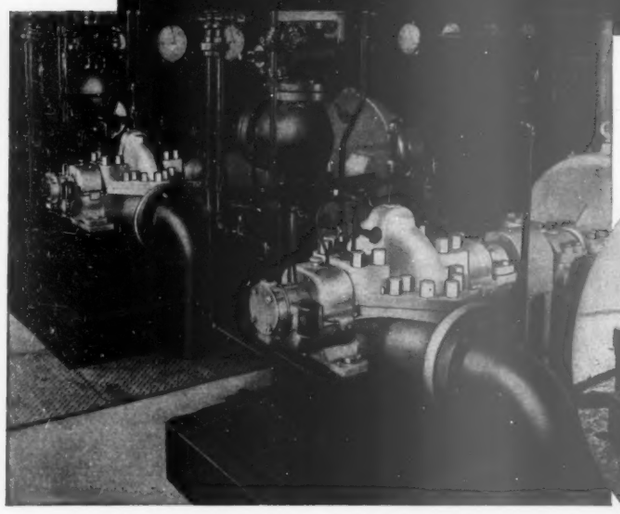
Reservoir Keeps Pump Cool Before Flow Starts

A high-capacity centrifugal water pump serving a deep water well tended to heat when starting up. There was danger that the pump casting would crack when the first water hit the hot pump base. The source of trouble was eliminated by installing a water reservoir adjacent to the motor of sufficient capacity to permit a stream of water to flow from the reservoir to the pump base and shaft, thereby keeping it relatively cool until the flow of water starts. A small flow line and valve has been located in the bottom of the reservoir to control the flow. When in use, the operator simply opens the valve after he has started the motor and after the water is raised from the well the reservoir is refilled. Then the small valve is closed until the pump is started again. The open tank also serves as a ready indicator of the pump "catching hold" and supplying water. The tank is so located that overflowing is not of serious consequence. An enclosed tank could be used if overflowing is a hazard.

REFINERY PUMPS THAT STAY ON THE JOB



One of two cracking-coil charging pumps having a capacity of 1400 gal per min installed in a large refinery.



Single-stage class JVL pumps charging a debutanizer with cracked distillate.

Single-stage class SFL pump serving a stabilizer.

- **Dependable operation is of major importance in refinery pumps. Our wide experience in this field, and unexcelled manufacturing, metallurgical and research facilities, enable us to produce pumps that stay on the job.**

Ingersoll-Rand pumps are successfully serving refineries of all sizes from 30 to 140,000 bbls. per day capacity. No matter what the service, whether it is handling water, butane, distillates, solvents, propane, gasoline, hot or cold oil or other refinery liquids, there is an I-R pump exactly suited to your needs.

The Ingersoll-Rand line includes a complete range of sizes and types of refinery pumps. Let our engineers help you with your problems.

Ingersoll-Rand Products for Petroleum Industry

Gas- and Diesel-Engine-Driven Compressors

Portable Compressors

Refinery Pumps

Water Pumps

Pipe-Line Pumps

Rock Drills

Demolition Tools

Steam-jet Vacuum Equipment

Impact Wrenches

Pneumatic Tools

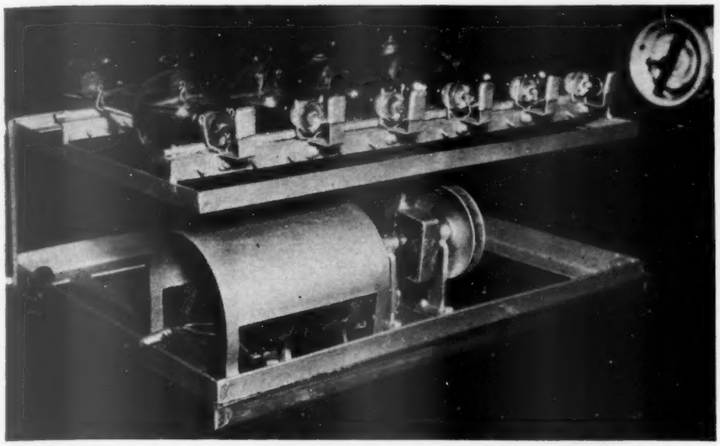
965-10

Ingersoll-Rand

CAMERON PUMP DIVISION 11 BROADWAY, NEW YORK, N. Y.

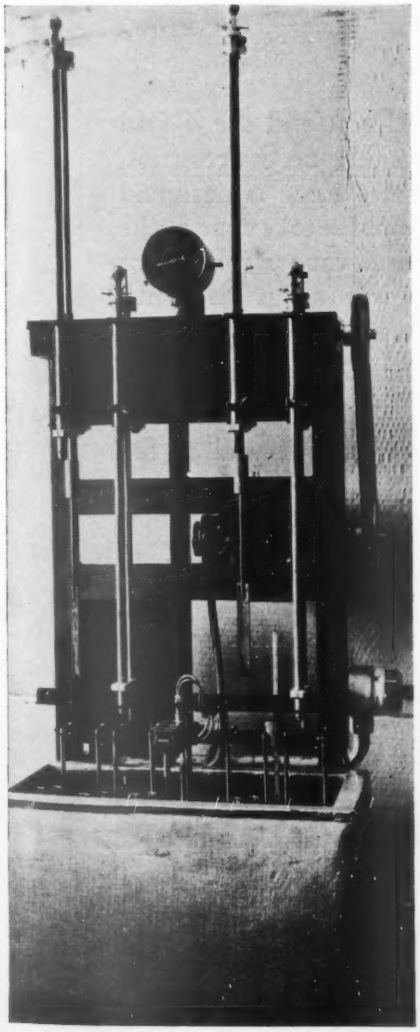
Atlanta, Birmingham, Boston, Buffalo, Butte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Duluth, El Paso, Hartford, Houston, Kansas City, Knoxville, Los Angeles, Newark, New Orleans, New York, Philadelphia, Picher, Pittsburgh, Pottsville, Salt Lake City, San Francisco, Scranton, Seattle, St. Louis, St. Paul, Tulsa, Washington

REFINERY GADGETS



Multiple-Unit Shaker Saves Operator's Time

This funnel-shaking apparatus is driven by a small electric motor by means of V-belts. Six funnels may be vigorously oscillated at one time, enabling one chemist to handle six times as many agitations as formerly. Motion is provided the assembly by an arm driven from a rotating gear. The extent of the shaking can be adjusted within limits by altering the position of the mounting. It has been found unnecessary to adjust the shaking so that it is violent and for this reason it is seldom necessary to make any substantial adjustments. The funnels are securely held in place in the frame by means of metal friction clips welded to the frame.

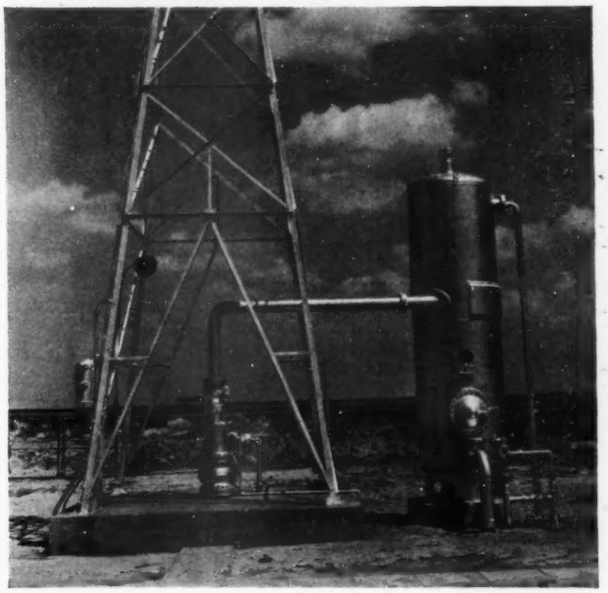


Multiple Emulsion Testing Machine

Time is saved and accuracy is promoted through the use of a multiple stirring device. Holding the samples in a constant bath, all conditions are ideal for check testing. The stirring device is electrically driven and the speed of the stirring is indicated on the tachometer mounted in the center. The assembly is built as a unit.

Separator Used on Water Well

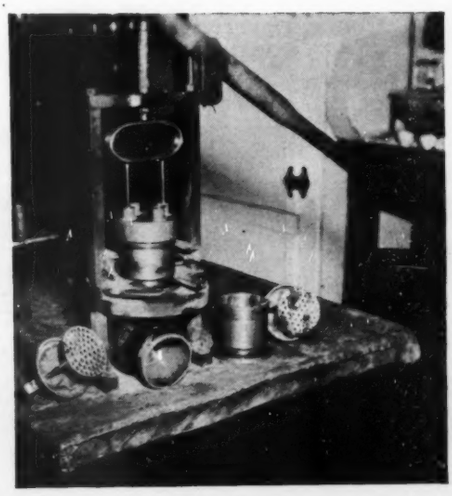
An ordinary oil and gas separator serves a plant in the Gulf Coast area as an economical and sure means for removing traces of sand which might be brought to the surface along with the water while the well is producing as a result of gas-



lifting. This well is about 400 ft. deep and the connections on the separator indicate the simplicity and dependability of the installation, including a large line off the bottom of the separator through which the sand may be flushed out at intervals. The hydrostatic head is sufficient to flush it.

Handle and Holder Used In Working Greases

Before worked penetration tests may be made on grease, the procedure provides for working that grease sample under definite conditions and for a definite time. Normally this is done manually but the work has been simplified by use of a pump-arm and frame which holds the test cylinder. The long pump-handle arm attached to this worker enables the operator to work very stiff grease samples without fatigue. The body of the worker is machined from brass and provided with a deep groove which fits into a receptacle on the base of the iron holder.



NO EVAPORATION LOSS

with this Expansion Roof

LOSS of gasoline by evaporation from storage or working tanks today is more costly to the refiner than ever before because it is a 4-fold loss. Every gallon that vanishes through your tank roofs carries with it, besides the gasoline itself:

The cost of producing the gasoline.

The easy starting qualities—because it's the light ends that go first.

Part of the octane value—because the light ends carry most of the anti-knock properties.

You don't need to suffer such losses any more—the remedy is simple, effective and available.

It is the Graver Expansion Roof.

Install it on a gasoline tank and you end the 4-fold loss of gasoline value at once—because no evaporation takes place. The Graver Expansion Roof is designed on a simple, common-sense principle—to expand the space as needed, holding the gasoline vapors instead of expelling them. Liquid sealed all around, it rises and falls as the vapors in the tank expand and contract.

The Graver Expansion Roof saves enough to pay for itself in a couple of seasons (or less) and goes on saving for you. The sooner you find out what it will do for you, the sooner you'll make it standard equipment on your gasoline tanks. Then your evaporation troubles will be over.

Send for Conservation Bulletin—It's free.

Some Advantages of the Graver Expansion Roof

All equalizing equipment inside, protected from weather.

Viscosity of oil in liquid seal is constant, unaffected by temperature changes.

Maintains conical shape, making it self-draining.

Requires no more maintenance than ordinary cone-roofed tank

Is fool-proof.

Other Features

Suitable for tanks of any capacity.

No shovelling of snow or ice from roof.

Equalizing mechanism can be adjusted if necessary from outside without taking roof out of service.

Will last as long as ordinary cone-roofed tank.

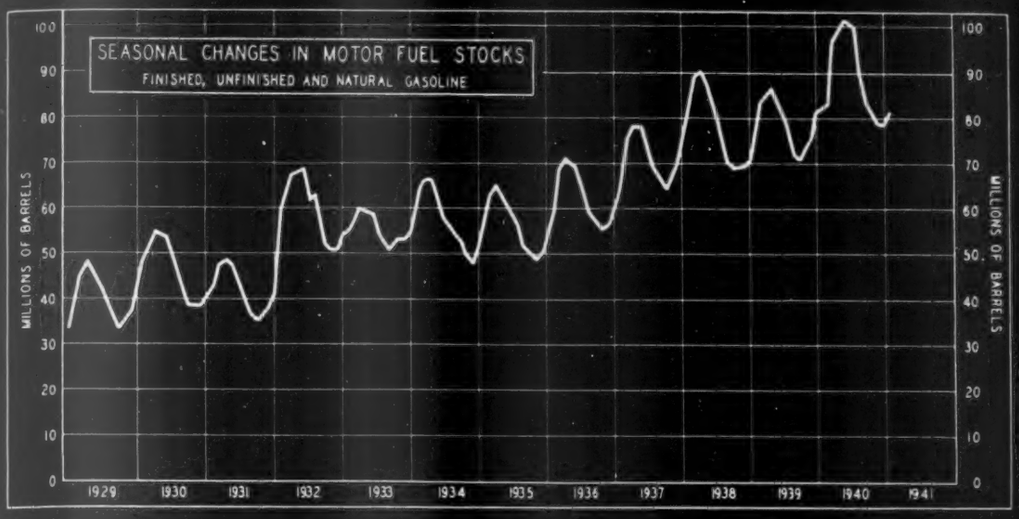
GRAVER TANK & MFG. CO., INC.

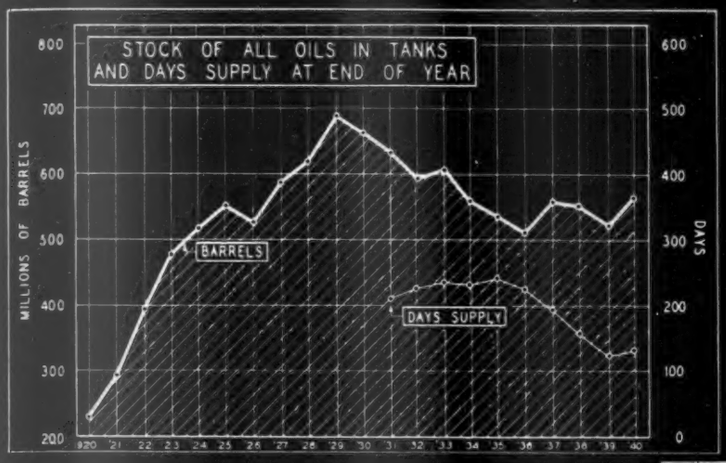
4014 Tod Avenue,
EAST CHICAGO, IND.
CABLE ADDRESS—GRATANK

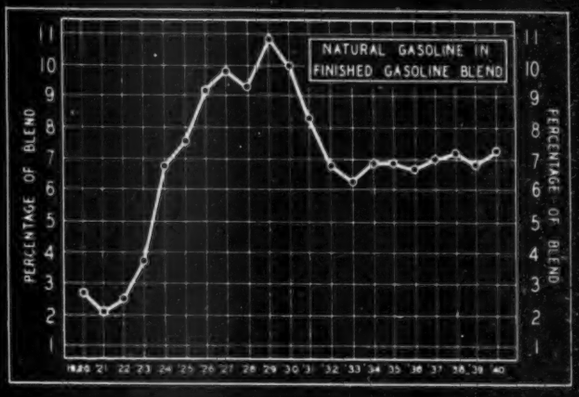
NEW YORK
CATASAUQUA, PA.

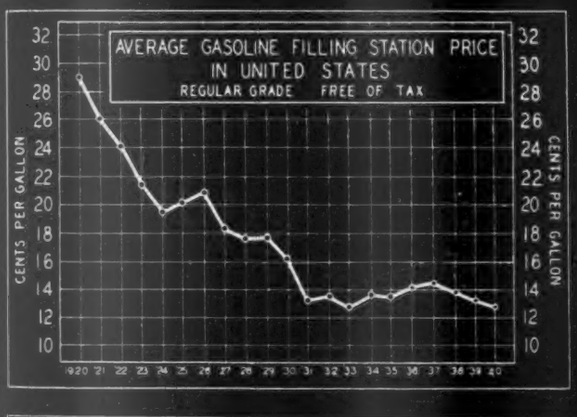
CHICAGO
TULSA

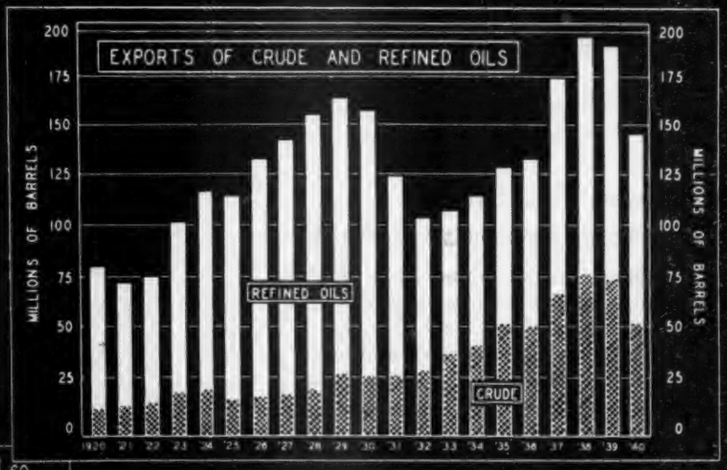
TRENDS In Refining

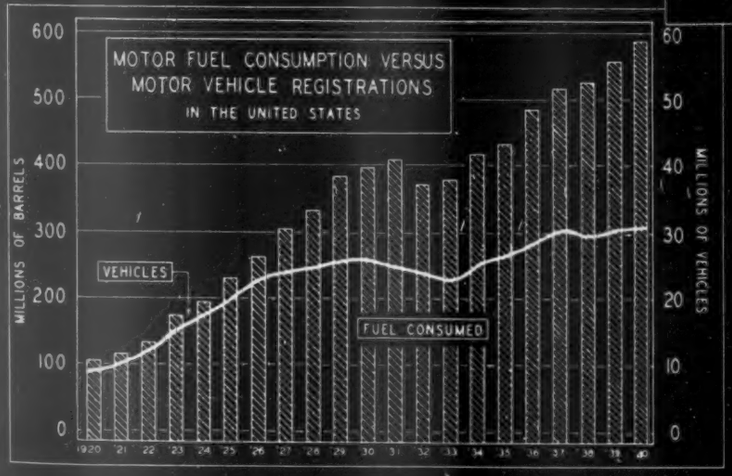

SEASONAL CHANGES IN MOTOR FUEL STOCKS
FINISHED, UNFINISHED AND NATURAL GASOLINE
MILLIONS OF BARRELS
MILLIONS OF BARRELS
1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941

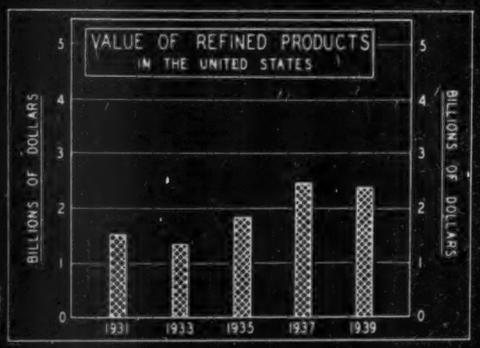




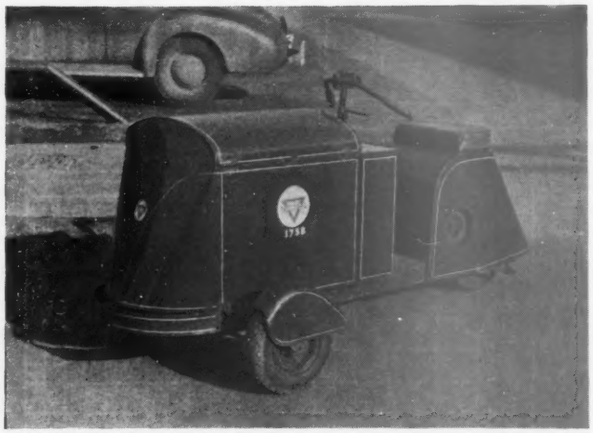








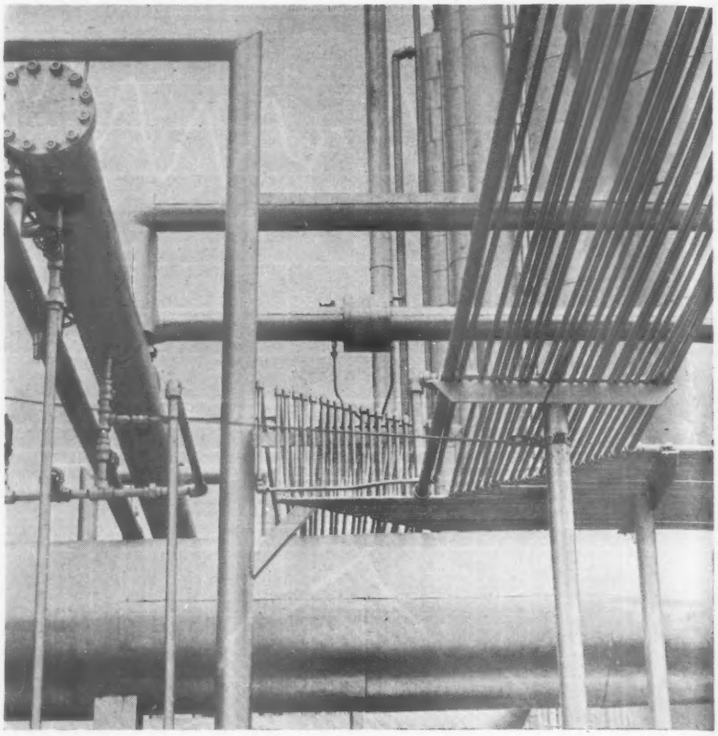
REFINERY GADGETS



Gasoline-Propelled Mail Delivery

Departmental notes and mail are distributed hourly over a large area and among many buildings by means of this little automobile. The company seems to be little concerned about the gasoline consumption as weighed against the time saved in getting the mail and notes distributed quickly.

Control Instruments Supported Overhead for Repair



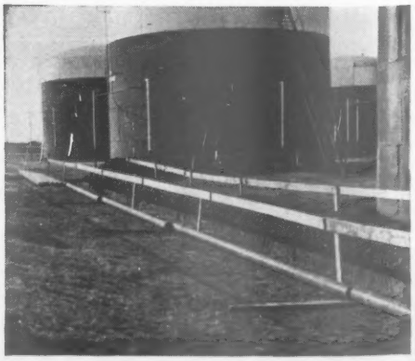
Buried lines and conduits become sources of trouble in a refinery as the number increases and as additions to the plant become necessary. The supporting of pipe lines and conduits overhead is now practiced more generally and many methods are used for supporting these lines. Here are shown 35 separate units coming from two elevations and making a right-angle turn. Angle-irons welded to the tops of a series post so that one flat side is exposed upward in each case offers a substantial and practicable rest for the pipe and conduits. One is shown directly above.

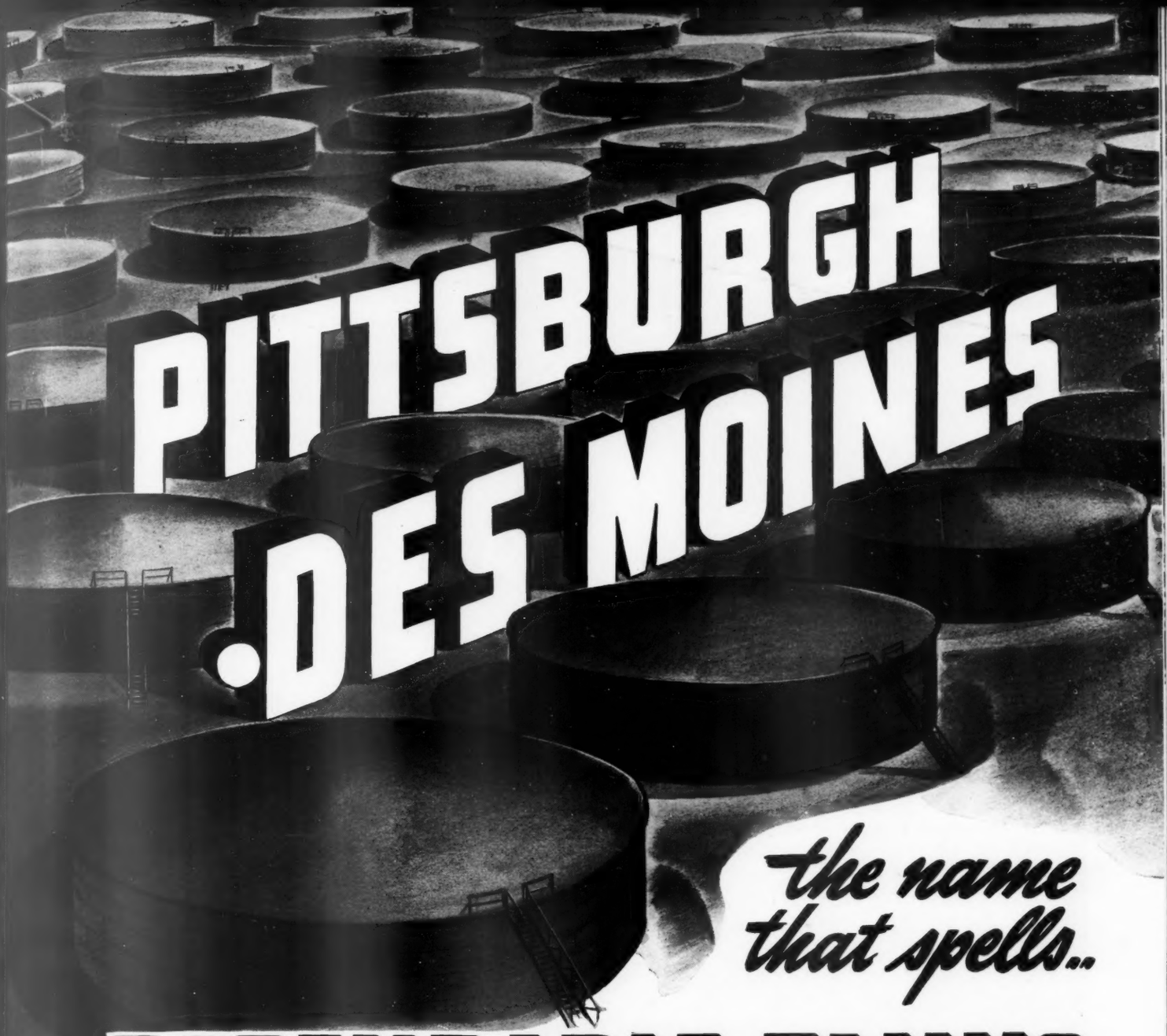
Closed Vent System Prevents Explosion Hazard

Handling highly inflammable fluids such as calodorant from bulk storage through measuring units and to drums for shipment requires the exercise of more than usual care because of the fire hazard. At an installation designed for these operating conditions fluid from the storage tank is flowed through a short line into the measuring unit directly below the main tank. A vent line from the top of this unit reenters the top of the storage tank and permits the vapor, from the unit, to enter the tank and replace the fluid being drawn out. The closing of both filling and vent valves assures a full measure of fluid. Fluid thus measured is run to drums by opening the small vent line paralleling the larger vent line, allowing vapor from the tank to reenter the measuring unit as its charge gravitates into the shipping drum, avoiding an explosive mixture.

Wooden Rail Along Ditch

Excavating for new pipe lines in the refinery is so common among most plants that the operator takes little added heed when a ditch is dug across his regular path. This invites accidents. As a precaution one company makes a practice of building a temporary wooden rail along both sides of the ditch whenever excavation is in progress. The simple form which the railing takes is shown in the picture. The posts are 2 by 4 in. while the top rail is a 1 by 6 in. low-grade lumber.





the name that spells..

DEPENDABLE TANKS

....AS YOU WANT THEM!

....WHEN YOU WANT THEM!

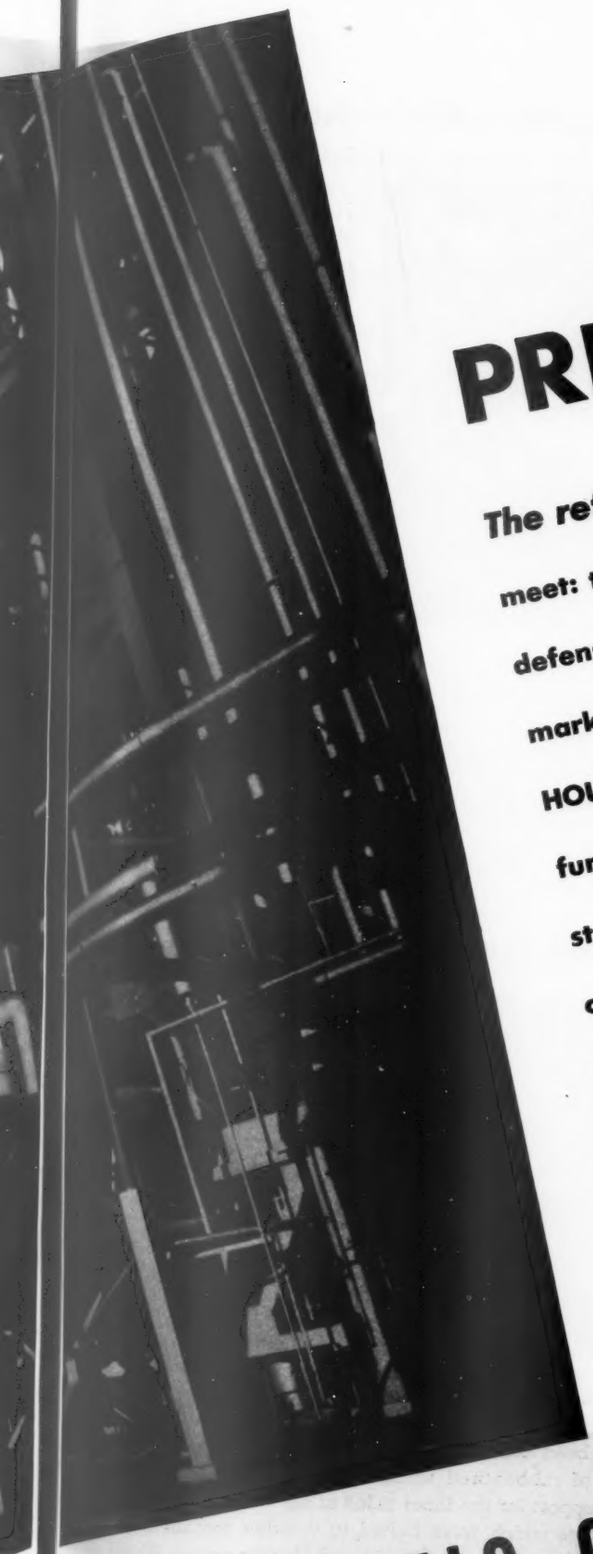
PITTSBURGH · DES MOINES STEEL CO.

PITTSBURGH, PA. 3496 NEVILLE ISLAND — DES MOINES, IA. 997 TUTTLE ST.

NEW YORK, ROOM 980, 270 BROADWAY . . . CHICAGO, 1202 FIRST NATIONAL BANK BUILDING

DALLAS, 1201 PRAETORIAN BUILDING . . . SAN FRANCISCO, 603 RIALTO BUILDING

HOUDRY



PREPAREDNESS

The refiner has a program of preparedness to meet: the program of aviation fuel for national defense ★ a program for a future motor gasoline market that will demand a higher octane fuel. **HOUDRY** can meet your program with an ability to function on all different types of charging stocks ★ with the production always of high octane gasoline ★ with a desirable flexibility in the production of other products ★ with an operating preparedness that comes from 18 units in operation and building with a combined charge capacity of over 200,000 barrels per day.

CATALYTIC CRACKING PROCESS

Licensing Agents for the Houdry Catalytic Cracking Process

E. B. BADGER & SONS CO.

BOSTON, MASS.

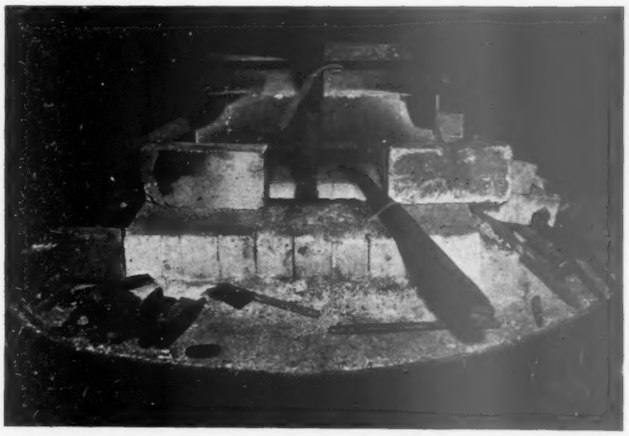
NEW YORK • PHILADELPHIA • SAN FRANCISCO • LONDON • PARIS

ENGINEERS AND CONTRACTORS FOR PETROLEUM DISTILLATION AND REFINERY EQUIPMENT

REFINERY GADGETS

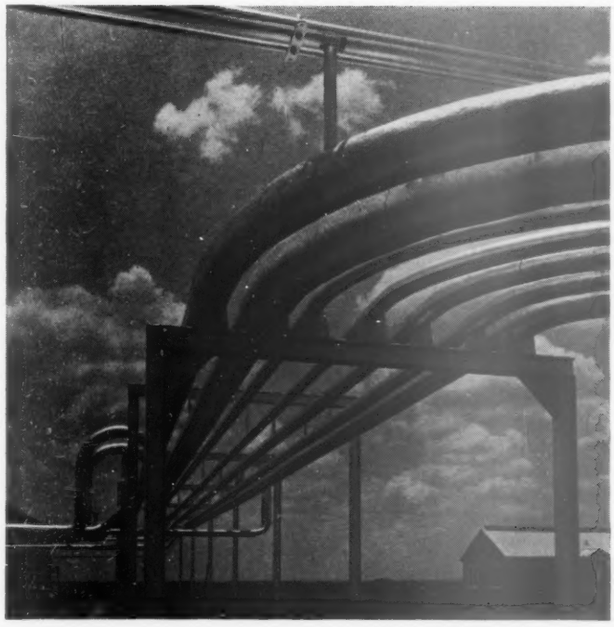
Forge Uses Gas as Fuel; Keeps Metals Clean

Relatively few refineries are large enough to justify a blacksmith shop. However, in one of these the general forge has been rigged up to burn gas instead of coal and a much cleaner operation results. The design of this forge is conventional except for a restriction or "hot zone" built of fire bricks and located over the combustion chamber. This may be seen in the accompanying pictures. Ordinary refinery gases are utilized as fuel, the high forging or welding temperatures being produced by using a jet of compressed air in the gas line near the combustion chamber. The gas and air come into the side of the chamber practices. The gas fire also has the advantage of supplying a more uniform temperature. The blacksmith can readily adjust the gas feed for the desired heat intensity after a comparatively short period of trial.



Rubber-Tired Truck Wheels Make Loading Easier

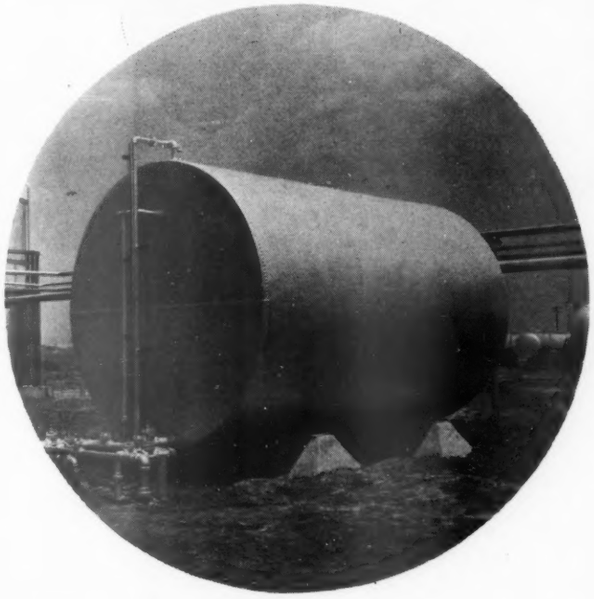
The ordinary two-wheeled loading truck that rumbles over the siding platform has been converted into an easy-moving, quiet conveyance at one plant. This has been accomplished by replacing the iron wheels and axle with a set of rubber-tired wheels. The common axle was dispensed with and support for the inner sides of the wheels was provided by angular plates which were bolted to wooden members of the truck frame and stiffened by an iron tie rod clearly shown here.



Pipe Supports Allow Free Movement

Most pipes being installed in new plants are supported overhead rather than being buried in the ground. This change has several advantages. However, the change has necessitated the erection of substantial supports. Here is shown one assembly which was recently completed and which provides several types. Each supplies positive, directional support without causing a strain on the pipe. In the picture the main framework of I-beams provides for suspending the pipes and also for letting the pipes rest on this frame. In the foreground the latter case is shown, while in the rear the adjustable swings may be seen. The concave supports mounted on the I-beam shown in the foreground are of special interest since support provides a positive rest for the pipe, and yet the pipe is free to elongate or shrink. Each support is made by welding an open section of pipe to the parallel edges of two rounded, flate plates and this assembly is welded to the I-beam frame. The width of the open pipe section will determine the area of the bearing surface and this can extend the full external diameter of the pipe to be supported. The weld tends to keep the pipe in shape.

REFINERY GADGETS

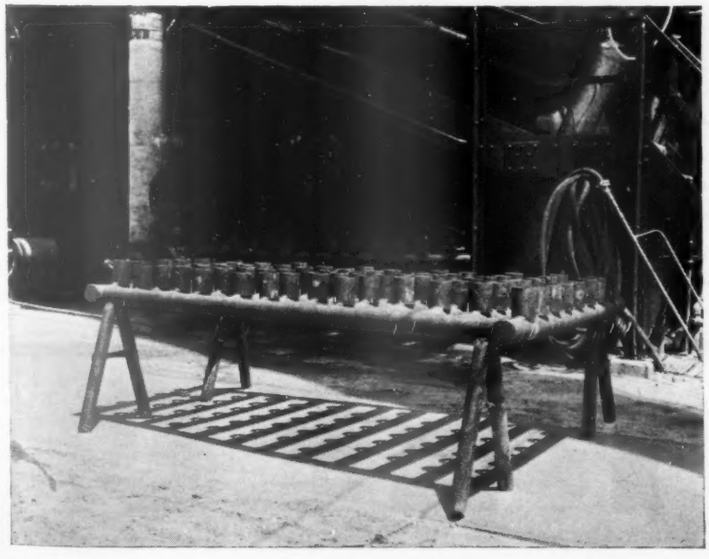


Rundown Slop Tank

Plants which process products with a fineness of specifications never before reached sometimes find it necessary to discard portions of a particular run. This can be most conveniently done by providing an auxiliary rundown tank or slop tank. One plant has solved its problem by erecting an old horizontal tank on a convenient location as shown here. This tank happens to be in a new recycling plant but the principle may be applied in refineries, gasoline plants, and recycling plants alike. No plant is free of oil contamination.

Juncture Box Cuts Down Time Looking for Trouble

When a circuit goes dead in the temperature-recording system of a refinery or natural-gasoline plant, the first assumption is that the instrument is at fault. This is proving to be less and less the case and as the number of electric lines or conduits through the average plant yard grows, the source of the trouble is becoming increasingly acute and in the lines themselves. To hasten the location of trouble and to enable the more prompt repair of shorted lines, one plant has located a juncture box in a central position in the yard to which and from which all electric wires run to thermocouples and instruments. One of these boxes is shown here and some of the conduits can be seen rising out of the ground and coming up through the base of the metal box. If a circuit is out of order it is a simple matter to check the side of the circuit out of order. From here it is a simpler job to find the exact location of the trouble. Also, the box enables the operator to make temporary connections to permit continued service while the faulty wire is being repaired. Sometimes a short extension will permit one wire to serve two duties and thereby relieve an emergency repair job.



Rack for Tube Returns Decreases Cleaning Time

Slight imperfections exist in the surfaces of the tube ends and tube-returns on any pipe still in prolonged operation. These tend to cause leaks after cleaning. One refiner has speeded up his tube-cleaning job and reduced leaks by supplying the operators with a return-bend rack. The rack provides a space for each return-bend in the same order as it was used in the furnace. As each end is removed it is placed in the corresponding position in the rack. Then when it comes time to place the ends back on the tubes, the same return goes into exactly the position it formerly held. Despite the finest precision used in making the tubes and the return bends, distortions may come into both as a result of heating or corrosion and a minimum of difficulty in assembling companion tubes and ends is realized when they are reassembled in the same manner over and over again. The rack is sturdy but not so heavy but that it can be easily carried by two operators.

REED ROCK BITS

The T BIT has deep, widely spaced teeth which provide maximum action on bottom and assure effective cleaning action in the soft to medium and sticky formations, including SHALE, SALT, RED BEDS, UNCONSOLIDATED SANDS and SOFT LIMESTONE.

Available in the 7½" through 26" range.

FOR INCREASED SERVICE LIFE AND LOWER DRILLING COSTS

P.O. BOX 2119, HOUSTON, TEXAS

REED

The REED *Interchangeable* MUD NOZZLE ASSEMBLY

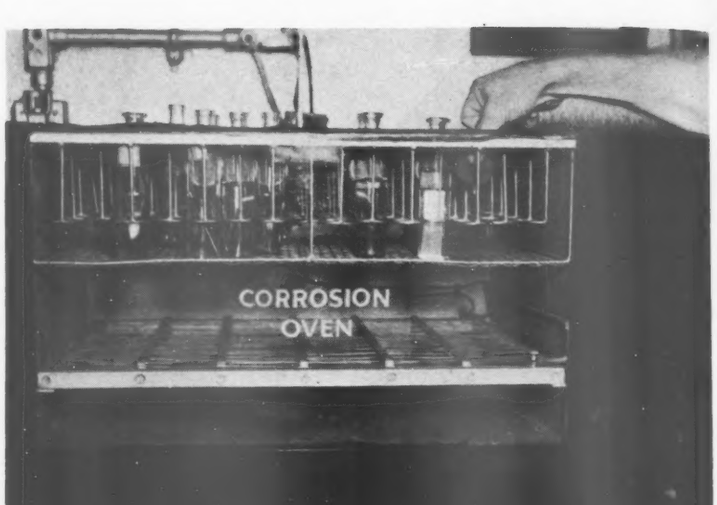
is easily replaced, and various sizes of jets may be had to accommodate any mud pump capacity or circulation requirements. Pump pressure holds the upper flange of the nozzle onto a gasketed shoulder on the shank of the bit head; thus providing a shut off of any circulation around the assembly. It is locked in place by a simple spring lock ring. For special work requiring maximum full opening through the bit shank such as "Reverse Circulation," "Drilling In," etc., the nozzle assembly may be left out entirely without impairing the strength or safety of the bit.

The jets are oval in shape to reduce turbulence, increase severity of jet action, and to distribute the cleaning over all cutter teeth. They are directed at an angle and at the roots of the cutter teeth so that the grooves between the teeth are met by the jets to thoroughly clean away any picked-up formation.

Available in the 5⅞" through 13" range

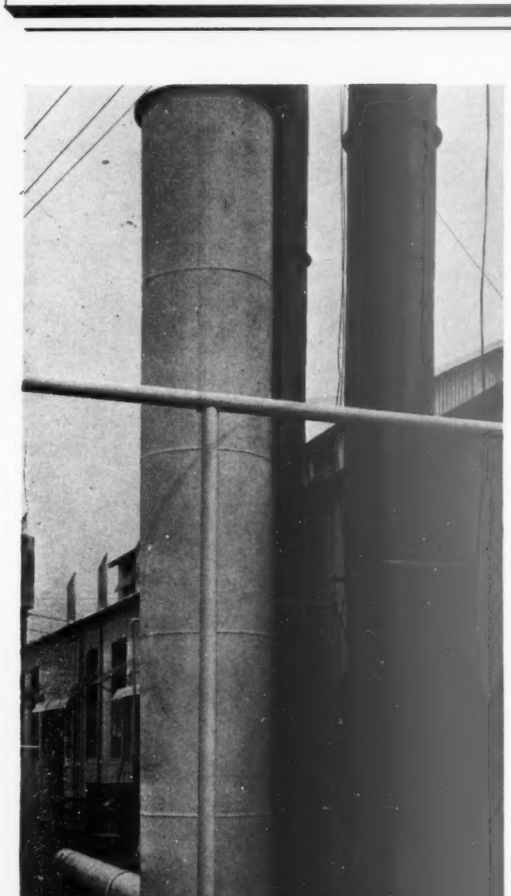
ROLLER BIT COMPANY

REFINERY GADGETS



Safe, Constant-Temperature Oven for Corrosion Tests

A constant-temperature oven used in the control laboratory of a large Gulf Coast refinery holds up to 24 samples of gasoline at 122° F. during the corrosion test, and without the danger of volatile fractions accumulating in the oven. This oven is thermally controlled by an electric heating compartment in the lower half as shown in the picture. Air is continuously circulated throughout the oven by a small fan. A slight air pressure is maintained inside the oven to drive any stray hydrocarbon vapors away from the enclosure instead of pulling them into it. A feature of the upper half of the oven is the manner in which sample bottles may be inserted and removed without disturbing the air conditions. This is accomplished by reason of the oven being equipped with a series of round, metal trapdoors which form the lid of the oven. One of these trapdoors is located over each sample holder. As the sample bottle is inserted it slips through a wire ring and rests on a coarse metallic screen. In the picture one of the doors has been pressed open by the operator. As may be seen, the neck of the bottle remains above the lid and the insertion of the bottle practically fills the opening left by the trapdoor.

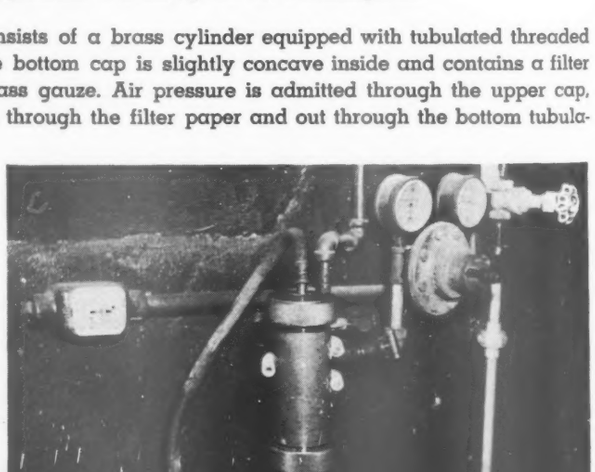


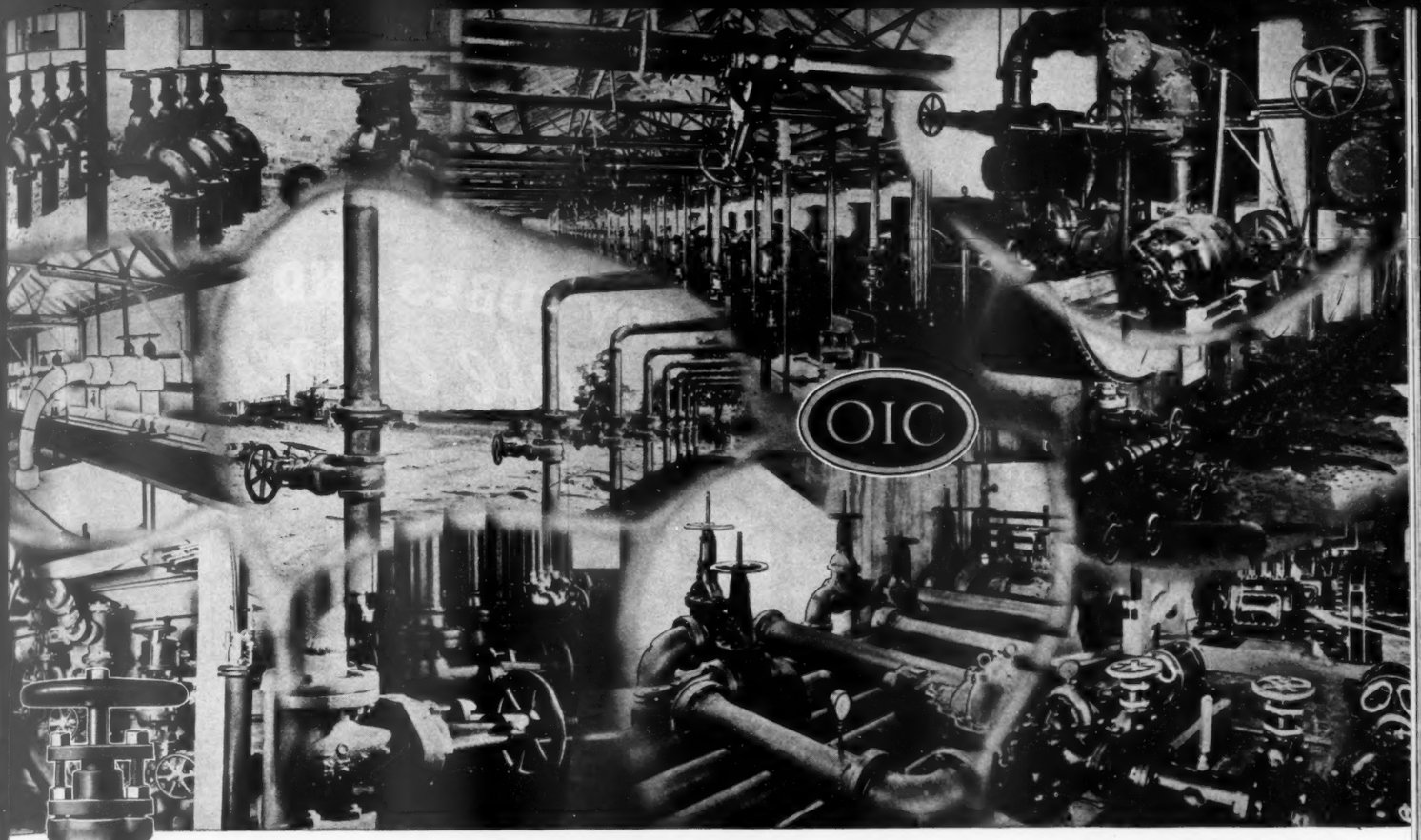
Boiler Blow-Down

Conserving water and relieving the plant sewer system from handling a heavy deposit of boiler scale, a plant in Illinois has provided permanent connections between a series of boilers and the blowdown tank. A feature of the installation is the ease with which the scale can be removed at ground level. The assembly consists of a 24-in. welded stack about 15 ft. high into which has been welded 10-in. pipe arms from opposite sides and at ground level. The 10-in. pipe acts as a manifold and can be extended if other boilers are added to the plant. The ends of the 10-in. line are flanged for cleaning. A water drain in the 24-in. riser permits recovery of the water condensate.

Pressure Filter Speeds Testing of Oil Samples

This pressure filter consists of a brass cylinder equipped with tubulated threaded caps at each end. The bottom cap is slightly concave inside and contains a filter paper resting on a brass gauze. Air pressure is admitted through the upper cap, thereby forcing the oil through the filter paper and out through the bottom tubulature. Care must be taken to limit the air pressure to the strength of the filter paper. Obviously a fine-mesh sturdy brass gauze will permit higher air pressures than if the filter paper is resting upon a coarsely woven screen. The operator soon becomes aware of the maximum pressure permissible for any given filter paper and he applies that pressure without using a great deal of forethought.





ARE YOU GETTING THESE VALVE BENEFITS?

1 Longer Uninterrupted Service
2 Lower Maintenance Cost
3 Lower Replacement Cost
4 Minimum Over-all Cost

See How OIC Gets All of Them for You:—

Fig. 137

Fig. 138

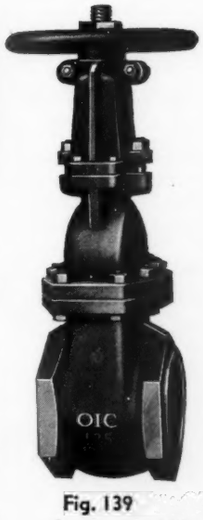


Fig. 139

Fig. 140

. . . O. I. C. Valves are now producing ALL of these benefits for users in industry everywhere, as impressive performance records attest.

. . . They've been doing it, too, for over half a century—for back of every O. I. C. valve stands more than fifty-seven years of engineering skill and progress, manufacturing integrity, and outstanding valve performance.

. . . The widespread application and increasing acceptance of O. I. C. valves throughout all industries are your assurance that in O.I.C.'s you get ALL the benefits that it is possible for valves to render.

. . . In this complete line of O. I. C. Iron Body Gate Valves — bronze mounted or all iron in Stationary Stem or Outside Screw and Yoke types, you get:

- A complete range of sizes.
- Extra rugged construction to reduce accident hazards.
- Greater over-all weight with more liberal use of metal to increase stamina at all vital points.
- Greater ease, and maximum efficiency of operation.
- Simplicity of construction, with free accessibility of all parts.
- Guides cast integrally, insuring positive wedge alignment, and to prevent marring of seating surface.
- Milled and slotted wedge for precision guiding, and to prevent chattering of disc when open.
- Positive shut-off without jamming, sticking or freezing.

YOUR COPY IS READY

Use reply form below to get your copy of new Broadside on O. I. C. Iron Body Gate Valves.

Learn why, from coast to coast, users of O. I. C.'s are saying:

"Oh I See! Lower Costs With O.I.C."

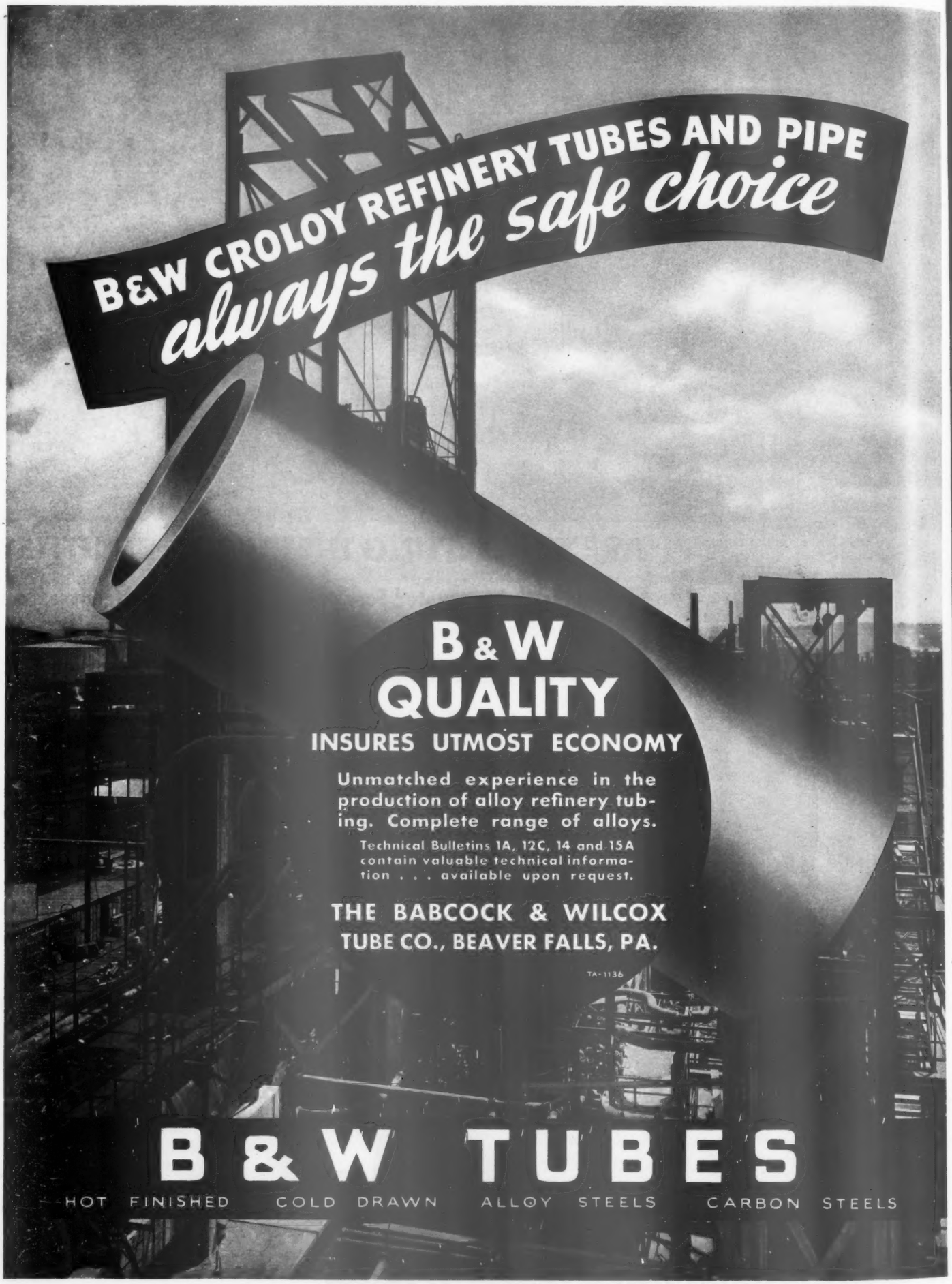
The Ohio Injector Co., Wadsworth, Ohio:
Please send me new Broadside on O. I. C. Iron Body Gate Valves and all their many benefits.

Name.....
Firm.....
Address.....
City..... State.....

THE OHIO INJECTOR COMPANY

WADSWORTH, OHIO

Quality Leaders in Valve Manufacture Since 1883

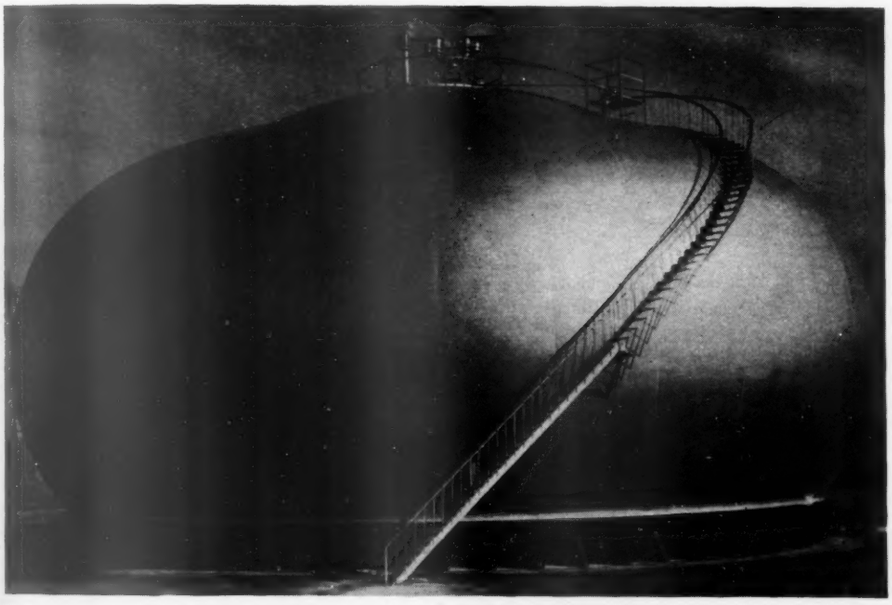

B&W CROLOY REFINERY TUBES AND PIPE
always the safe choice
B & W
QUALITY
INSURES UTMOST ECONOMY
Unmatched experience in the production of alloy refinery tubing. Complete range of alloys.
Technical Bulletins 1A, 12C, 14 and 15A contain valuable technical information . . . available upon request.
THE BABCOCK & WILCOX
TUBE CO., BEAVER FALLS, PA.
TA-1136
B & W TUBES
HOT FINISHED COLD DRAWN ALLOY STEELS CARBON STEELS

Maintenance of Large Pressure Storage Vessels

By D. E. LARSON
Development Engineer, Chicago Bridge & Iron Co.

The conservation of light hydrocarbon fractions has become a definite part of modern refining operations and pressure storage has thereby become a part of every modern plant. The design of these tanks differs from the conventional and the maintenance of these tanks calls for specific inspection detail and care. The author suggests ways to avoid pressure-tank abuse.

MILLIONS of barrels of motor fuel, natural gasoline and liquefied petroleum gases are now stored in pressure containers capable of preventing shrinkage in volume and deterioration in quality, due to evaporation, for any desired period of time. Although the use of pressure storage vessels on a large scale has successfully solved the evaporation-loss problem, it has also introduced some problems of maintenance not encountered in the use of ordinary storage tanks operating at, or slightly above, atmospheric pressure. There is a tendency on the part of some operators to regard these pressure containers as ordinary storage tanks—a mistake which may involve serious consequences. The purpose of this article is to discuss the precautions that should be taken to insure the safe and efficient operation of all sizes of pressure vessels designed for working pressures ranging from 2½ to 30 lb. per sq. in.



Large pressure containers such as this Hortonspheroid present maintenance problems quite different from those encountered in the operation of ordinary storage tanks

Every pressure vessel, regardless of size, is designed to operate safely at some specified working pressure. An adequate factor of safety is included in the calculations to insure that the vessel will never be damaged unless the conditions of loading assumed in the design are greatly exceeded. It is seldom practical or economical to make the vessel sufficiently strong to withstand all conceivable operating contingencies. Consequently, the operator must be charged with the responsibility of seeing that safe working conditions are maintained. The factors which might lead to a structural failure are as follows:

Corrosion.

It would be possible for corrosion to decrease the thickness of the shell plate to such an extent that structural failure would occur under the loading for which the vessel was designed. This possibility may be, and usually is, offset by arbitrarily increasing the shell thickness in cases where it is known that the vessel is to be used for the storage of a product having corrosive properties. Regardless of whether such an allowance has been added, it is advisable to inspect every part of a pressure vessel periodically to make sure that no section has been seriously weakened by corrosion. If severe corrosion is discovered, it may be necessary to operate the vessel at a lower pressure than that for which it was designed and to limit the upper liquid level to a point below the original high-capacity line.

Liquid pressure.

If, during filling, the pumps are not shut off when the liquid surface reaches the high-capacity line, the vessel may be completely filled, thus allowing the internal liquid pressure to build up to a point where the resultant stresses in the shell will rupture the plates. Although this danger can be averted by installing a liquid-level alarm or a float-controlled shutoff switch at the high-capacity line, most pressure vessels are not so equipped. The responsibility of safeguarding the vessel against excessive liquid pressure is usually left entirely to the operator, who must stop the flow of incoming liquid at the proper time to prevent damage.

Gas pressure.

A structural failure may also be caused by excessive gas pressure resulting either from the compression of the gas in the vapor space during filling or from a rise in vapor-space pressure accompanying an increase in atmospheric temperature. The internal gas pressure is not so easily controlled as the liquid pressure. Consequently, one or more automatic pressure-relief valves are usually provided to allow vapor to escape whenever the vapor-space pressure tends to exceed the safe working pressure.

Partial vacuum.

As a rule, large pressure vessels are not designed to withstand a partial vacuum of any appreciable magnitude. When a partial vacuum is created, either by the removal of liquid from the vessel or as a result of decreasing atmospheric temperature, the vessel may collapse inwardly. To guard against this possibility, it is common practice to install one or more vacuum valves to admit air whenever the allowable partial vacuum tends to be exceeded.

Having outlined the conditions which might lead to a structural failure, we may now examine the possible consequences of such a failure both for a pressure vessel and for an ordinary tank operating at atmospheric pressure. It is not uncommon for atmospheric storage tanks to be damaged as a result of excessive pressure or vacuum. Such tanks are usually equipped with relief vents adjusted to open whenever the pressure or partial vacuum tends to exceed a value of ½ oz. per sq. in. If the vents fail to open as the pressure increases beyond this value, the roof plates will be lifted off the rafters, subjecting the connecting angle at the top of the shell to a compressive stress which may cause it to buckle in one or more places. The roof plate is usually torn at each point of buckling, thus making a series of openings which relieve the pressure and prevent further structural damage. The greatest danger from such an occurrence lies in the possibility that the escaping vapors may become ignited from some outside source.

If the vacuum-relief vent fails to open when the tank is being emptied, or when the vapor-space temperature is falling rapidly, the resulting vacuum may cause the tank shell or the roof, or both, to collapse. When the shell only is damaged, the buckles can sometimes be forced out by filling the tank with water. Repairs to the roof, however, will usually require the use of some new material, thus making it necessary to steam out the tank so that burning and welding equipment can be used safely.

An atmospheric tank subjected to excessive pressure or vacuum usually fails in such a way that none of the stored liquid escapes. Thus, while the repairs may be expensive, the only serious hazard is a fire hazard created by open holes in the roof plates.

A pressure-vessel failure caused by excessive vacuum is no more serious than a similar failure in an atmospheric tank, that is, the shell is pulled in without any loss of stored product or without damage to anything but the structure itself. Such failures are less likely to occur in a pressure vessel because most large pressure containers such as Hortonspheres and Hortonspheroids have a double-curved shell which enables them to withstand a much greater partial vacuum than a cylindrical tank. On the other hand, the repairs to a pressure vessel, necessitated by a vacuum failure, would probably be more expensive than similar repairs to a cylindrical tank.

The consequences of a pressure-vessel failure caused by excessive pressure may be more serious than those resulting from excessive vacuum. Let us suppose that the vessel is being filled and that the safety relief valve sticks and does not open

Relief valve for storage tank maintaining working pressures up to 10 lb. per sq. in.

when the safe working pressure is reached. As the filling proceeds, the pressure continues to rise above the safe point until the shell plates are subjected to a tensile stress sufficient to cause failure. The space above the liquid in the vessel is filled with compressed gas containing a tremendous amount of energy. When the shell fails and rips open, this volume of compressed gas is suddenly released with an almost explosive force which may ruin the vessel, allow the stored product to escape and damage adjacent property.

Upon completion, Hortonsphere and Hortonspheroids are filled with water and then tested with compressed air to a pressure at least 25 per cent above the working pressure for which they are designed. This test insures that failure will never occur under normal conditions provided the plate thicknesses are not greatly reduced by corrosion. It does not insure that the vessel will not be damaged by the greatest pressure that could conceivably occur in some emergency. As previously explained, it is not economical to design a vessel for the stresses which would exist in such an emergency. Pressure vessels are normally safeguarded against excessive pressure or vacuum by installing safety relief valves.

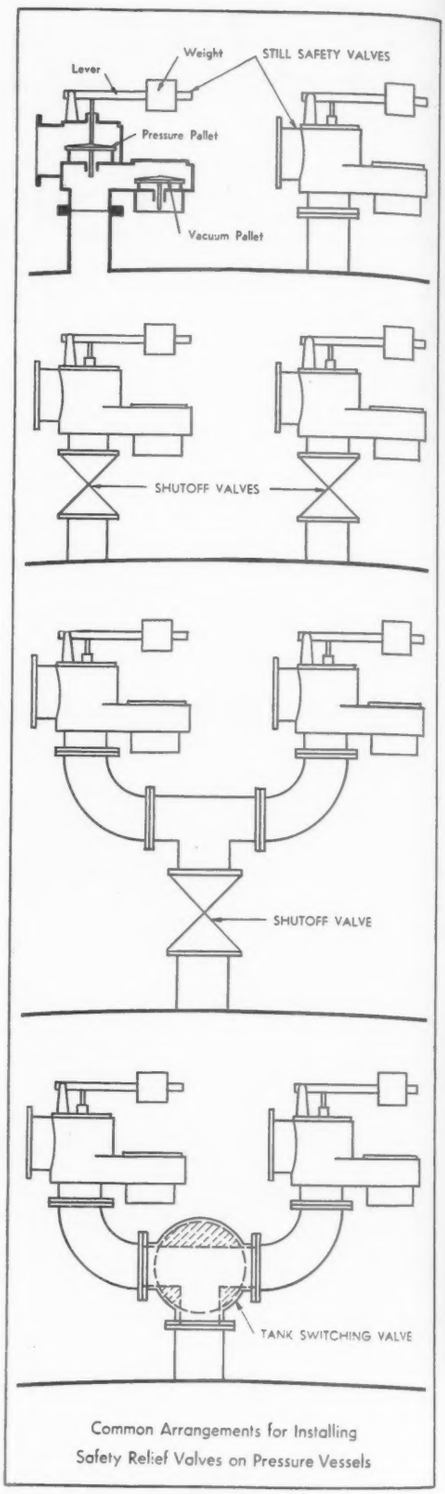
Disadvantage of Devices

While it is clear from the foregoing that pressure and vacuum-relief vents are a necessity, it must also be pointed out that they constitute something of a liability. The reasons for this are:

1. If, for any reason, the valves fail to open when the safe amount of working pressure or vacuum has been reached, the vessel may be wrecked with possible loss of life or damage to adjacent property.
2. If, after venting, the valves fail to close properly, vapor will escape, thus decreasing the efficiency of the vessel.

It is evident that the safety of a pressure storage tank of any kind, as well as its efficiency, is entirely dependent upon the proper functioning of the safety valves. It is only within the past several years that the problem of designing relief vents suitable for large vessels operating at relatively low pressures has received the attention it merits. The development of valves suitable for this class of service has been slow. No one has yet been able to perfect a relief valve capable of operating indefinitely without a certain amount of attention. In fact, it is doubtful whether such a vent valve will ever be produced, because a relief valve often operates under the most unfavorable conditions to which a piece of mechanical equipment could possibly be subjected.

The type of safety relief vent most commonly used on pressure vessels operating at working pressures of from 10 to 30 lb. per sq. in. is the so-called still safety valve, which is a single-vent unit containing a vacuum-relief valve set to open at a partial vacuum of approximately 2 oz. per sq. in., and a pressure-relief valve loaded by means of a weighted lever to open at the pressure for which the vessel is designed. The main parts of such a vent valve are shown in an accompanying illustration. In order to see what attention is needed to maintain one of these vents in proper working condition, let us consider some of the things which may prevent it from operating as it should.



Common Arrangements for Installing Safety Relief Valves on Pressure Vessels

Ice.

It is possible for the pallet to be held to the seat ring by the freezing of drops of moisture. This is a fairly common occurrence when the atmospheric temperature is at or just below the freezing point. Most still valves are designed in such a way that the drops of water which condense in the housing cannot fall on the valve seat. Nevertheless, there is always a chance that some moisture will condense on the under side of the pallet and freeze.

Paint.

When a pressure vessel is being painted, or repainted, careless workmen who do not understand the working of a relief vent may spray paint into the openings, thus causing the pallet to adhere firmly to the seat when the paint dries. A recent inspection of many large pressure vessels disclosed that several vents had been rendered inoperative in this manner.

Corrosion.

The inside of a vent on a tank used for sour products may become badly corroded. This causes the formation of a quantity of rust or scale, some of which falls down on the vacuum-valve pallet and tends to keep it from opening at the partial vacuum for which it is set. The inspection mentioned above revealed that some of the relief vents contained several handfuls of scale. Corrosion, plus an accumulation of dirt, may increase the friction of the moving parts to such an extent that the valve will not open when the safe pressure or vacuum is exceeded.

It has been shown that structural damage to a pressure vessel, due to excessive pressure, may entail consequences more serious than those involved in the failure of a cylindrical storage tank. It is also true that the relief valves on a pressure container are subjected to more severe operating conditions than the vents on an atmospheric tank. An atmospheric tank expels vapor almost every day and takes in air almost every night. Since

Bring that
"INCURABLE" PACKING
PROBLEM
to JOHN CRANE
25 years of "clinical" experience . . . thousands
of "cures" are your assurance of solution
RESILIENT
Patented
TAPE-BACKING
"break-proof"
(Illustrated)
SUPER-SEAL PLASTIC
(TAPE-BACK)
★
Newest . . . Super-Seal is an example of
John Crane progressive policy of anticipating
changing demands! . . . Designed to stand-up
to today's peak-loads . . . Plastic types of
varying characters to fit required services . . .
Dry-graphited; nothing to be squeezed out or
drawn-off under pressure . . . Anti-frictional;
vulcanizing tape to outer surface prevents
fracturing while installed, eliminates friction
because only resilient plastic contacts shaft

Processed by

PLUS-PAK

that xxtra which lasts twice as long!

SERVICES:

STEAM, superheated and saturated

WATER

AIR & GASES

OILS & PETROLEUM

CHEMICAL PROCESSING

REFRIGERATION

239 John Crane styles . . . scientifically engineered to specific services . . .

Recommending packings to achieve definite results is parallel to writing a prescription; qualified education is imperative: chemistry, engineering; clinical experience is indispensable. Since there is no valid substitute for these fundamentals engineers will relieve their problems and hedge against reoccurrence by utilizing such technical counsel, especially since John Crane offers consultation without cost. This procedure avoids excessive costs of leakage and shutdown.

☆

OG-341

CRANE PACKING COMPANY, Chicago, U.S.A.
CRANE PACKING COMPANY, Limited, Hamilton, Ontario, Canada

NAME _____ TITLE _____

ADDRESS _____ COMPANY _____

CITY OR TOWN _____ STATE _____

the vents are in operation almost constantly, they have little chance to become stuck except as a result of freezing. Inasmuch as the primary function of a pressure vessel is to eliminate this constant venting and the resulting loss, the relief valves remain closed for long periods of time and are called into play only at infrequent intervals. A pressure vessel may operate for months without emitting vapor or taking in air. This inactivity affords an opportunity for the pallets to become stuck and creates a situation that can be successfully combated only by careful inspection at regular intervals.

It is common practice to install relief vents in duplicate. This practice is based on the hope that both vents will never stick or become inoperative at the same time. It is reasoned that if one valve should fail to open at the proper time, the other one will function, thus protecting the vessel from damage. While this practice is followed almost universally, there is some question whether the second vent adds very greatly to the safety of the vessel. The still valve is somewhat sluggish in operation and, when two are used, it is almost impossible to adjust them to open and close together. The result is that the vent which opens at the lower pressure or vacuum takes care of all venting under normal operating conditions. When this happens, the second vent remains idle for such a long period of time that it may fail to open in an emergency unless it has been inspected and tested regularly.

Inspection can be greatly facilitated by installing the vents in such a way that they can be checked without affecting or disturbing the operation of the vessel in any way. The accompanying sketches show four different ways in which a pair of still valves may be installed on a pressure vessel. Regardless of how the valves are mounted, the pressure side of each one can always be tested very easily when the vessel contains pressure by the simple procedure of lifting the weight and lever. If the pallet is free, it will rise and vent vapor to the atmosphere, thus indicating that the valve is working properly.

The topmost sketch shows two still valves mounted directly on the tank. This arrangement is not recommended, because the vacuum pallets cannot be tested and the insides of the vents cannot be inspected when the tank is under pressure. For this reason, it is desirable to mount each still valve on a shutoff valve as shown in the second sketch. This makes it possible to blank off one still valve for inspection or repair at any time. The shutoff valves may be either gate valves or lubricated plug valves. The shutoff valve is usually provided with a lock so that it can be locked open, thus preventing it from being closed by unauthorized persons. The use of shutoff valves facilitates inspection, but it also introduces a hazard, because there is a possibility that the inspector may close both valves and leave without opening them again. This danger can be averted by the use of an interlocking-cam arrangement which makes it impossible to close both shutoff valves at the same time.

The third sketch shows a fairly common arrangement consisting of two still valves mounted on a single shutoff valve of larger diameter. This is not as safe as some other arrangements, because both vents are blanked off at the same time, thus leaving the vessel without a relief vent while the inspection or repair work is in progress.

The fourth sketch illustrates the use of a tank switching valve which makes it impossible to blank off both vents at the same time.

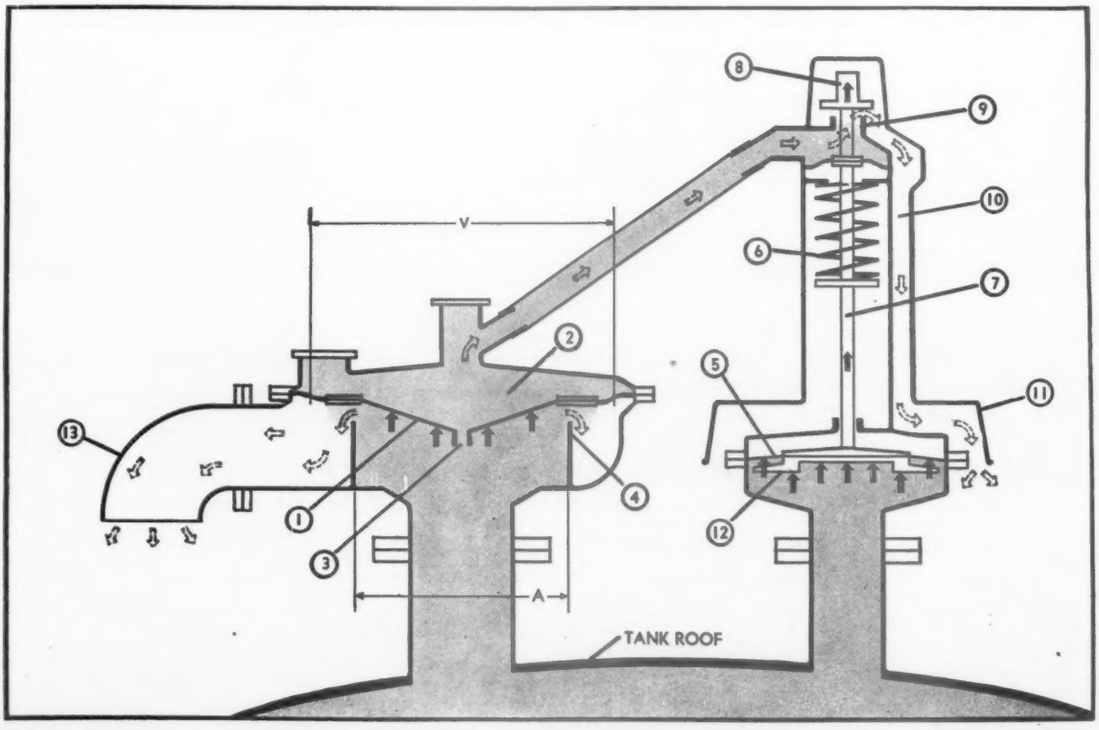
It is not within the scope of this discussion to review the arguments for and against the use of flame arrestors in connection with pressure-vessel vent valves. Some oil companies use them while others consider them unnecessary. If flame arrestors are used, however, it is imperative that a shutoff valve be placed between each arrestor and the tank so that the flame-arrestor bank can be removed for inspection and cleaning. The tubes or apertures in a flame arrestor are small and easily clogged, and if they are not cleaned regularly, the flow capacity may be reduced to the point where the vessel will be damaged by excessive pressure or vacuum.

Suggestions for the maintenance of still valves are as follows:

1. At intervals of not more than 2 weeks all still-type relief valves should be inspected as follows:
   (*a*) Lift lever to see that it operates freely and that the pallet is free to lift. If pressure is in the tank the pressure side will vent when the lever is raised.
   (*b*) Check the vacuum pallet to see that it will lift freely. To do this, a shutoff valve under the still valve should be closed, or the inspection should be done at a time when the tank pressure is low.
   (*c*) Investigate any tendency to stick or bind and immediately repair the source of trouble. Watch particularly for ice at seats or guide stems in cold weather.
2. At intervals of not more than 1 year, preferably just before freezing time, take the still valve apart and clean it.
   (*a*) Use clean kerosene to remove any deposits from the seats.
   (*b*) Polish guide stems and guide bushings to bright metal.
   (*c*) Repair any leaks at seats.
   (*d*) Thoroughly clean out inside of valve body.
3. If flame arrestors are used, each tube bank should be inspected once a month to make sure that the passageways are not clogged. The passageways should be cleaned when necessary.

A discussion of this sort would be incomplete without some mention of the work being done to develop improved safety relief vents. A still valve has very poor operating characteristics. It will nearly always permit some leakage to occur before the working pressure is reached and, being sluggish in operation, it will often allow the tank pressure to rise above the safe working pressure before opening. After opening, it will permit the tank pressure to fall below the working pressure before closing. This variation between the opening and closing pressures is not serious in cases where it represents a small percentage of the safe working pressure as it does in vessels designed for working pressures of 10 lb. per sq. in. or more.

The use of still valves for a working pressure below 10 lb. per sq. in. may jeopardize the safety of the vessel and destroy its operating efficiency. By way of illustration, a still valve on a 2½-lb. vessel may allow the pressure to rise to 3½ lb. per sq. in. before it opens and then blow down to 1½ lb. before it closes. The pressure-regulator type of relief valve illustrated in the accompanying di-



Working drawing of relief valve showing parts

1. *Upward force at main pallet*
2. *Chamber at tank pressure*
3. *Orifice*
4. *Ring seat for pallet*
5. *Diaphragm*
6. *Calibrated spring*
7. *Vertical stem*
8. *Pilot valve*
9. *Pilot-valve seat ring*
10. *Exhaust port*
11. *Hood*
12. *Disk*
13. *Weather hood*

A = smaller diameter and V = larger diameter of effective areas

Reduced materially the cost of making 100 octane gasoline over other methods.

Reduced the capital cost by one third over that of another type of unit designed to do the same thing.

These results were obtained on a recent Kellogg-built unit—the largest ever designed and constructed for this particular process.

When you have a processing problem consult the Kellogg Company because advantages similar to the above may be available to you.

KELLOGG

LICENSING AND CONSTRUCTION AGENTS under United States and foreign patents for:
Catalytic Processes for Cracking, Reforming, Dehydrogenation, Alkylation, Desulphurization

- Gasoline Products Company, Inc., Pyrolytic Cracking
- The Polymerization Process Corporation, Thermal and Catalytic Polymerization
- JUIK Processes for Lubricating Oil Refining with Propane and Phenol Deasphalting · Dewaxing · Solvent Extraction and Acid Treating Plants
- The Gray Processes Corporation, Clay Treating

THE M. W. KELLOGG COMPANY • JERSEY CITY, NEW JERSEY • 225 BROADWAY, NEW YORK

Los Angeles: 609 South Grand — Tulsa: Philtower Building

EUROPEAN REPRESENTATIVE: Compagnie Technique des Petroles, 134 Boulevard Haussmann, Paris, France.

Reliability

Reliability requires
PRIME STEEL

Because, to make a high quality steel product, the steel itself must be right. Harrisburg has built a reputation for reliability over a long span of years, since 1853. Harrisburg quality products have been sold in all parts of the world and to customers who are "regular" year in and year out. It takes more than men and machines and steel to make a reliable product . . . it takes executive, metallurgical and engineering control that follows in the tradition Harrisburg has been creating for over three-quarters of a century.

HARRISBURG STEEL CORPORATION
HARRISBURG · PENNSYLVANIA

agrammatic sketch was developed to provide a venting device that would open with certainty under all kinds of climatic conditions whenever the tank pressure tended to exceed the safe working limit and close after venting with a minimum of blowdown.

The operation of the regulator, as illustrated by the diagrammatic sketch, is as follows:

Under normal working conditions, an upward force is exerted on the main pallet (1) by the tank pressure acting over the area shown as *A*. The pressure in chamber (2), which is equalized with tank pressure through orifice (3), acts over an area *V* to exert a downward force on the pallet. Since the effective diaphragm area *V* is considerably greater than area *A*, the pallet is held firmly in place against the seat ring (4). In this way, the vent is kept tightly closed at all pressures within the working range.

When the venting pressure is reached, the upward force of the tank pressure acting on diaphragm (5) in the control unit counterbalances the downward force of the calibrated spring (6) and causes the vertical stem (7) to rise, opening the pilot valve (8) and venting chamber (2) to the atmosphere through exhaust port (10). As chamber (2) is depressured, the main pallet is lifted by the pressure acting on its underside and the excess vapors are vented outward through the weather hood.

Venting will continue only as long as the internal pressure tends to exceed the working pressure. When the tank pressure starts to drop below this, the valve (8) closes and chamber (2) is repressured through orifice (3) causing the main pallet to close and remain closed until chamber (2) is again vented by the action of the control unit.

The regulator operates with a sufficient reserve force to break a film of ice on the seating surface of the main pallet or the pilot-valve pallet. The regulator has another feature that is very unusual: it is designed in such a way that the main valve will open instantly if either of the flexible diaphragms becomes ruptured or if any working part gets out of order. This safeguards the vessel against damage from excessive pressure in case the regulator becomes inoperative for any reason whatever. Sensitive operation has been assured by avoiding the use of bearings, stuffing boxes or sliding parts. Friction is held to an absolute minimum by the use of freely floating moving parts.

Although the safety regulator was designed primarily for releasing excess pressure, it also serves as an emergency vacuum vent. The main pallet opens to admit air into the vessel when a pressure vacuum of 2 oz. per sq. in. has been reached. This device is manufactured for the Chicago Bridge & Iron Co. by the Shand & Jurs Co. of Berkeley, Calif.

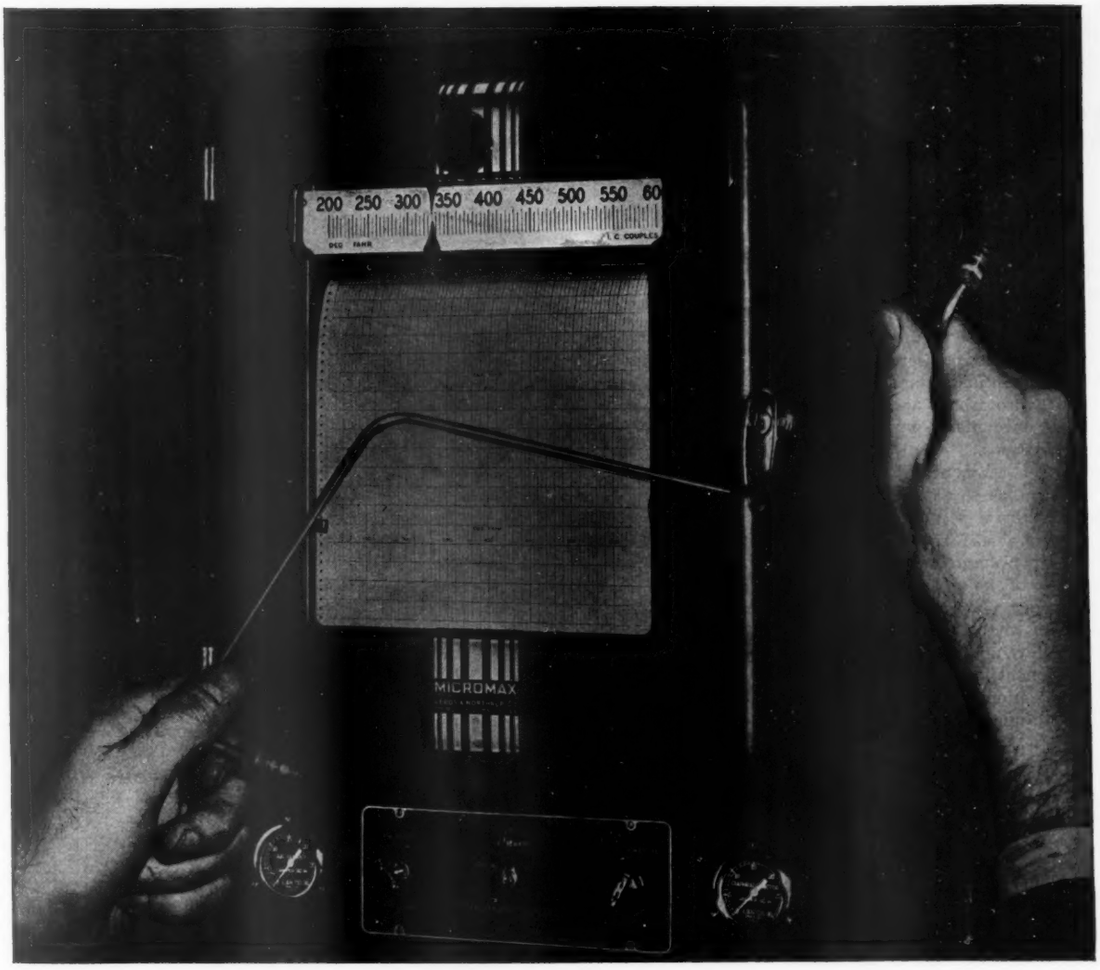
Regulators of this type are now used on Horton-spheroids for pressures up to and including 10 lb. per sq. in. and may eventually be available for vessels operating at higher pressures.

●

To Determine Elk Hills Reserves

LOS ANGELES, Calif., Mar. 24.—The federal Government will drill at least one well in the Elk Hills field, Kern County, California, this year in order to determine the value of various holdings of Standard Oil Co. there preparatory to the institution of condemnation proceedings. All leases of Richfield Oil Corp. which are on government permits expire at various times during 1941 and it is the intention of the Navy Department to take possession of these properties upon expiration of leases and suspend production.

It is estimated that Elk Hills will produce 200,000,000 bbl. of crude oil and this should be ample for Navy requirements for many years. Standard Oil Co. is drilling two wells at Elk Hills and has made two additional locations.



This "*Enormous*" Tube...

Compared to a tube in a cracking coil, the tube shown above is small. But, for the job it has to do in a Micromax Pneumatic Controller, it's enormous.

"Different" design permits the use of this husky tubing, in the channel along which Micromax acts so swiftly and instantly in holding temperature where you've set it. And oversize tubing is typical of the many scores of details, handled *in an unusual manner* to make Micromax Pneumatic Control micro-responsive and thoroughly dependable.

Micromax is outstandingly easy to apply—it reaches the refinery on its own panel, with all settings at hand in front, completely ready for work. See Catalog N-00B, "Micromax Pneumatic Control."

LEEDS & NORTHRUP COMPANY, 4959 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Jrl Ad N-33A-702(34)

Equilibrium Constants for a Gas-Distillate System

By C. H. ROLAND, D. E. SMITH and H. H. KAVELER
Phillips Petroleum Co.

Vaporization equilibrium constants for the lighter components of petroleum-hydrocarbon mixtures are not only functions of pressure and temperature but also of inherent characteristics of the heavier components present. The constants may also depend upon the composite composition of the system made up from a given liquid and gas.

Experimental data must be obtained on a wide variety of systems before the composition variables may be evaluated. The data reported are those for a typical Gulf Coast gas-distillate system in the range of 200-4,000 lb. per sq. in and 40° to 200° F.

The vaporization equilibrium constants observed for methane through heptane plus differ from those reported on crude-oil and absorption-oil systems. The data indicate that the composite composition of the mixtures of gas and distillate studied has little effect upon the numerical value of the constants determined.

PETROLEUM-HYDROCARBON mixtures may exist either as single-phase liquid or gas, or, as coexisting two-phase systems. Whenever two phases are present, individual constituents of the mixture distribute themselves between the phases in a manner determined by the nature of the system, the temperature and the pressure. This fact is particularly important in understanding the behavior of petroleum hydrocarbons and in solving engineering problems encountered in oil production and refining operations.

The distribution of a component between coexisting phases is a familiar physical phenomenon first extended to the study of petroleum-hydrocarbon systems by Souder et al.[1] They proposed to measure the liquid-vapor-phase distribution of a component as the ratio of the mol per cent of the component in the vapor phase to the mol per cent of the component in the equilibrium liquid phase. The numerical value of the ratio so obtained for any component was conveniently referred to as the vaporization equilibrium constant of the component. The number might well have been called the "distribution coefficient" or the "partition coefficient" since some confusion now arises in the discovery that the ratios so obtained can be regarded as constants only with respect to pressure, temperature and certain composition variables.

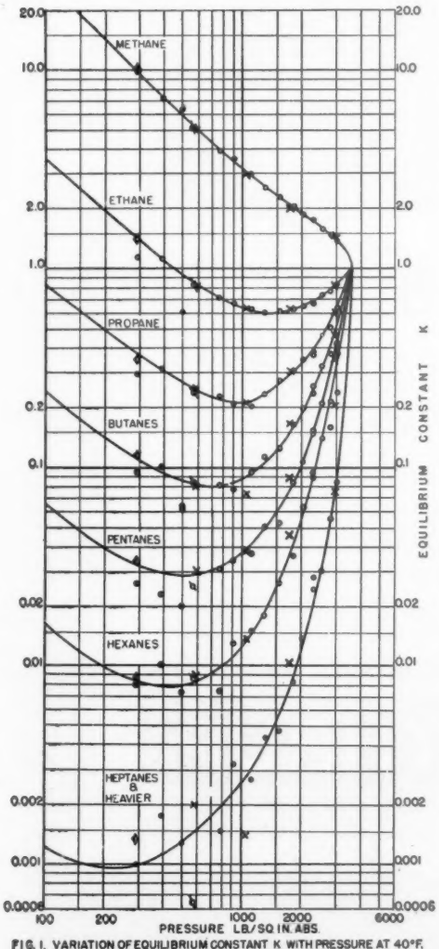


FIG. 1. VARIATION OF EQUILIBRIUM CONSTANT K WITH PRESSURE AT 40°F. DIAMONDS ARE FOR 50, CIRCLES FOR 70, CROSSES FOR 85, & CIRCLES WITH LINES FOR 90 MOL PER CENT METHANE IN COMPOSITE.

Experience has shown that vaporization equilibrium constants cannot be predicted from the properties of the pure components of a mixture. They must be experimentally determined. The constants reported by Katz and Hachmuth[2] on a crude-oil natural-gas system, the work of Sage and Lacey[3] on two-component systems in particular, and Webber's[4] observations on an absorption-oil natural-gas system have been significant contributions to the study of vaporization equilibrium constants.

The accumulated data indicate that the numerical value of the vaporization equilibrium constant for any component varies not only with pressure and temperature but also with the composite composition of the system and with inherent characteristics of the individual components present in the mixture. The variation of the constant with composition may be very great in the higher pressure ranges and may be dependent, qualitatively at least, upon the critical pressure of the system.

One of the currently important problems in establishing a system of vaporization equilibrium constants is to determine individual constants in a wide variety of systems. It may be possible to obtain with sufficient data an evaluation of the functional dependence on composition to the end that the choice of constants for any particular system may be greatly simplified.[5]

The purpose of this paper is to present vaporization equilibrium constants for a system made up of a Gulf Coast distillate and natural gas for temperatures of 40°, 120°, and 200° F. in the pressure range 200-4,000 lb. per sq. in. The experiments were conducted in a manner to study the effect of composite composition on the vaporization equilibrium constants for methane to "heptanes and heavier."

Apparatus

The equilibrium cell used in these experiments was constructed from a piece of 5-in. stainless-steel still tubing by welding to each end a hemispherical head forged from stainless steel. The cell was tested to 20,000 lb. per sq. in. and had a capacity of approximately 2 l.* The cell was suspended on a rocking mechanism in a thermostatically controlled bath maintained at ±0.2° F.

Two openings at the top of the cell were fitted with short lengths of ⅛-in. high-pressure steel tubing. One tube extended just inside the cell wall and was used for withdrawing a sample of the equilibrium gas phase. The other extended into the cell and was used to withdraw samples of the equilibrium liquid phase. The tubes were

*The first cell used had a capacity of 850 cc. It proved to be too small.

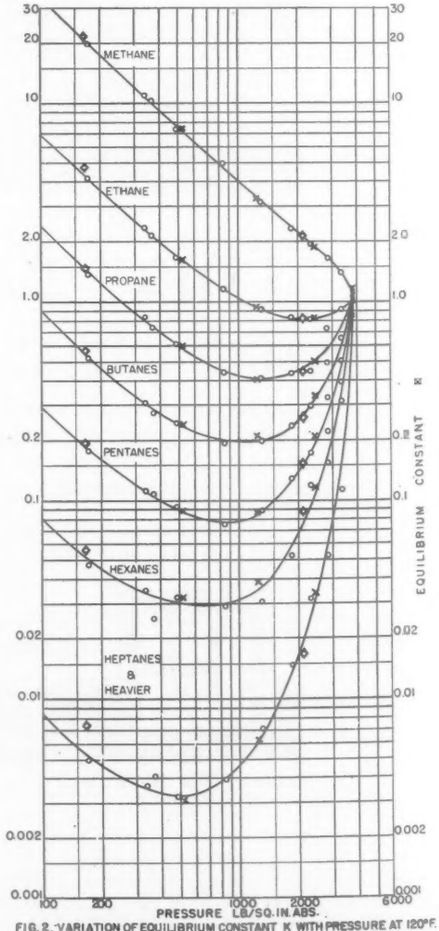
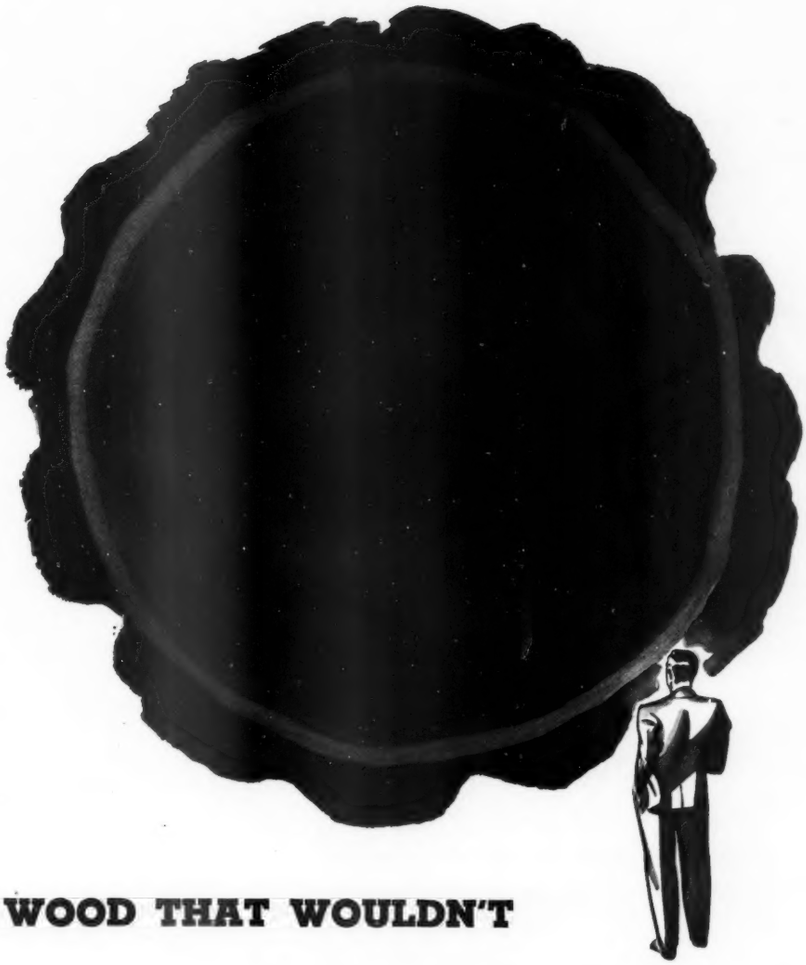


FIG. 2. VARIATION OF EQUILIBRIUM CONSTANT K WITH PRESSURE AT 120°F. DIAMONDS ARE FOR 50, CIRCLES FOR 70, & CROSSES FOR 85 MOL PER CENT METHANE IN COMPOSITE.

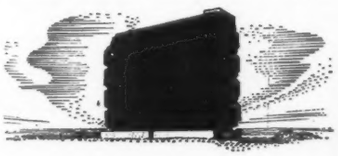


THE WOOD THAT WOULDN'T

What keeps a Fluor Cooling Tower at everlasting efficiency during years of continued service?

You'll find the answer in design, construction, materials and craftsmanship.

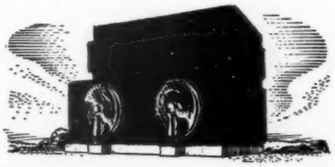
Let's concentrate on materials for a moment. Almost 99% of a tower's material bulk is wood. We had to have a wood that, except under unusually severe conditions, wouldn't rot, wouldn't warp, or



that wouldn't deteriorate, although subjected to heat, moisture, dryness or extremes of temperature.

Such are the characteristics of California Redwood—the only wood that wouldn't.

And, in addition, Redwood contributes greatly toward the good appearance that is built into every Fluor Cooling Tower.



Fluor standardizes on California Redwood, carefully selected for cooling tower service. The long life of a Fluor Tower is further assured by the high quality and practical adaptability of all other materials used in fabrication.

For complete descriptions of Fluor Atmospheric *Aerator Type* Cooling Towers and Fluor Mechanical Draft Cooling Towers, request copies of Bulletins T-337 and MDT-340.

Another Reason To fl *Be Sure with Fluor*

THE FLUOR CORPORATION LTD.
2500 So. Atlantic Blvd., Los Angeles, Calif.
KANSAS CITY • HOUSTON • CHICAGO
PITTSBURGH • NEW YORK

FLUOR
COOLING TOWERS

TABLE 4—PHASE ANALYSES AND EQUILIBRIUM CONSTANTS FOR COMPOSITE CONTAINING 50 MOL PER CENT METHANE

Pressure: / Temperature:	291 lb. per sq. in. abs. 40° F.			168 lb. per sq. in. abs. 120° F.			2,141 lb. per sq. in. abs. 120° F.			2,248 lb. per sq. in. abs. 200° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K
Methane	9.38	93.73	10.20	4.20	89.97	21.42	44.49	95.06	2.14	42.12	93.98	2.23
Ethane	1.76	2.46	1.40	0.74	3.51	4.74	1.97	1.62	0.82	1.92	1.90	0.99
Propane	2.49	0.87	0.35	1.45	2.16	1.49	1.68	0.75	0.446	1.70	1.03	0.61
Butanes	4.67	0.54	0.116	3.57	2.00	0.56	2.79	0.72	0.258	2.88	1.05	0.37
Pentanes	6.08	0.21	0.034	5.87	1.12	0.191	3.81	0.58	0.152	3.84	0.66	0.17
Hexanes	11.89	0.10	0.009	12.84	0.72	0.056	7.02	0.61	0.087	7.83	0.86	0.110
Heptanes and heavier	63.73	0.09	0.001	71.33	0.52	0.007	38.24	0.66	0.017	39.71	0.52	0.013

fitted outside the cell with high-pressure valves mounted on top of the cell.

An opening at the bottom of the cell was fitted with ⅛-in. tubing coiled about the rocking arm and extending to a mercury reservoir and pressure-gage manifold. This tube was used to transfer mercury into the cell, to regulate and to measure the cell pressure.

Three Bourdon gages with capacities of 1,000, 5,000 and 10,000 lb. per sq. in., a dead-weight gage for frequent calibration of gages, mercury pumps and a volumetric mercury pump were also connected into the manifold system.

Materials Used

The distillate used in these experiments was water white and had an A.P.I. gravity of 57.5°. It was a stock-tank liquid produced from a Gulf Coast gas-distillate well with distillation characteristics as shown in Table 1. A fractional analysis of components lighter than heptanes is given in Table 2.

TABLE 1—U.S.B.M. HEMPEL DISTILLATION OF DISTILLATE

Temp., °F.	Volume over cc. initial	Per cent over	Total per cent over	Gravity °A.P.I.
94-122	7.6	2.5	2.5	89.7
122-167	24.4	8.1	10.6	82.4
167-212	60.0	20.0	30.6	68.2
212-257	63.7	21.2	51.8	60.0
257-302	43.6	14.5	66.3	55.4
302-347	32.5	10.8	77.1	51.0
347-392	20.2	6.4	83.5	47.8
392-437	14.0	4.7	88.2	44.8
437-482	10.4	3.5	91.7	42.1
482-527	10.2	3.4	95.1	40.2

Distillation loss 4.9 per cent. Gravity of distillate 57.5° A.P.I.

TABLE 2—ANALYSES OF CHARGING MATERIALS USED IN MAKING COMPOSITES FOR EQUILIBRIUM-CONSTANT DETERMINATIONS

Hydrocarbon—	Distillate composition, mol per cent	Natural-gas composition, mol per cent
Methane	...	91.794
Ethane	0.441	4.049
Propane	1.604	2.051
Butanes	4.753	1.428
Pentanes	7.577	0.516
Hexanes	12.507	0.111
Heptanes and heavier	73.148	0.051
Sp. gr. at 60° F.	0.7666	.....
Mol wt.	119.5	.....
A.P.I. gravity at 60° F.	57.5	.....

TABLE 3—REPRESENTATIVE COMPOSITES OF DISTILLATE AND NATURAL GAS STUDIED

	Composites represented by mol per cent methane			
Hydrocarbon—	50 mol per cent	70 mol per cent	85 mol per cent	90 mol per cent
Methane	50.56	69.73	86.27	90.37
Ethane	2.23	3.18	3.38	3.99
Propane	1.32	1.94	2.33	2.03
Butanes	2.09	2.23	2.07	1.45
Pentanes	3.28	2.21	0.69	0.61
Hexanes	6.20	3.09	0.90	0.32
Heptanes and heavier	34.32	17.62	4.36	1.23
No. of individual sets of equilibrium constants observed for each composite	4	33	12	1

A fractional analysis of the natural gas obtained from a high-pressure well in the Gulf Coast is also presented in Table 2.

Experimental Technique

The technique used in these experiments was similar to that of others who have used a rocking-type equilibrium cell.[4,6]

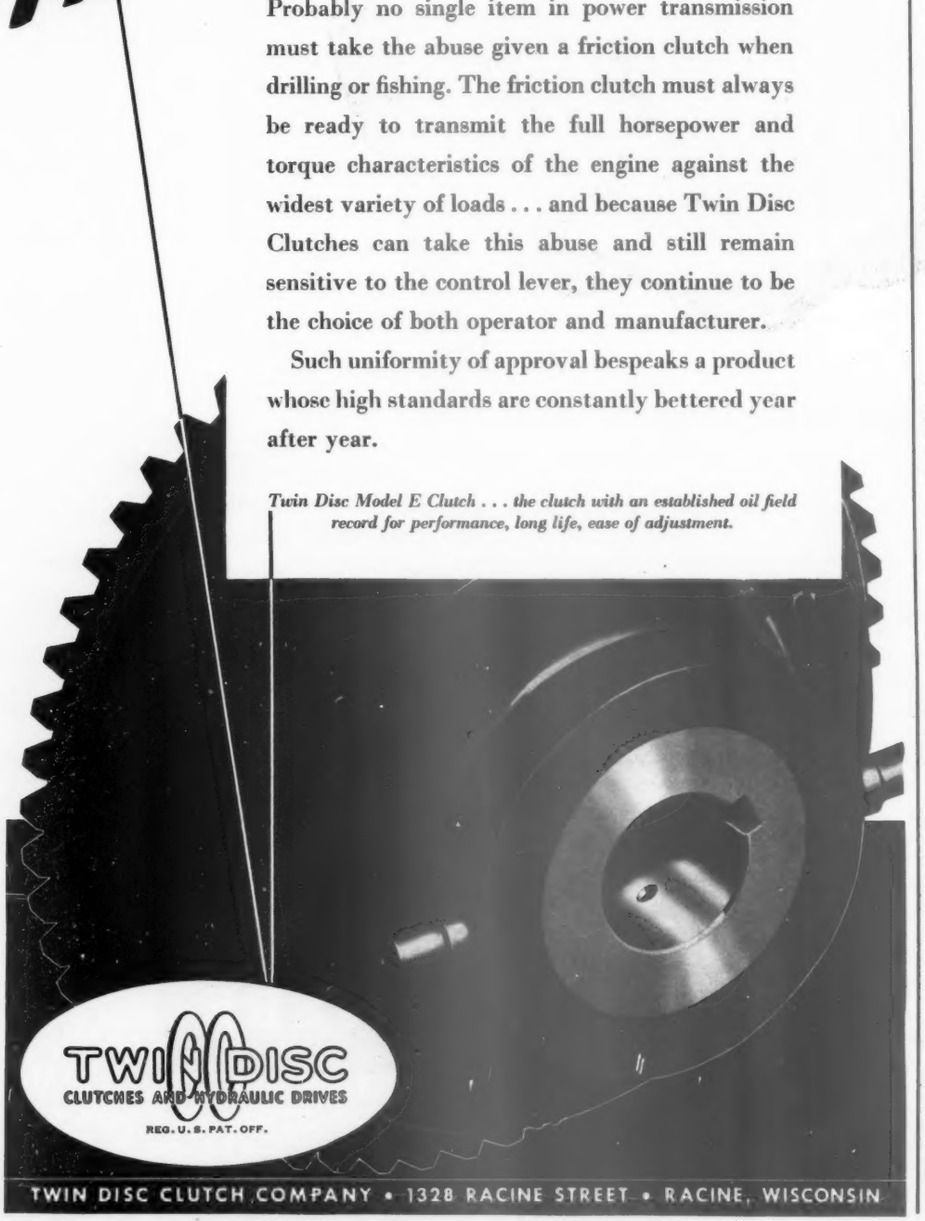
The equilibrium cell was evacuated and measured quantities of both distillate and gas were charged to the cell so as to produce a liquid-gas mixture of constant composite composition. The experimental composites are referred to as the 50, 70, 85 or 90 mol per cent methane composites.

ABUSED . . . but still sensitive

Probably no single item in power transmission must take the abuse given a friction clutch when drilling or fishing. The friction clutch must always be ready to transmit the full horsepower and torque characteristics of the engine against the widest variety of loads . . . and because Twin Disc Clutches can take this abuse and still remain sensitive to the control lever, they continue to be the choice of both operator and manufacturer.

Such uniformity of approval bespeaks a product whose high standards are constantly bettered year after year.

Twin Disc Model E Clutch . . . the clutch with an established oil field record for performance, long life, ease of adjustment.



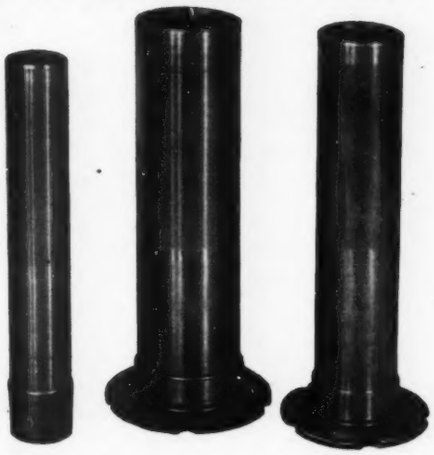
TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES
REG. U. S. PAT. OFF.

TWIN DISC CLUTCH COMPANY • 1328 RACINE STREET • RACINE, WISCONSIN

TABLE 5—PHASE ANALYSES AND EQUILIBRIUM CONSTANTS FOR COMPOSITION CONTAINING 70 MOL PER CENT METHANE

Pressure: / Temperature:	293 lb. per sq. in. abs. 40° F.			395 lb. per sq. in. abs. 40° F.			499 lb. per sq. in. abs. 40° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K
Methane	9.503	94.444	9.938	13.030	93.910	7.207	15.365	96.644	6.290
Ethane	3.057	3.492	1.142	3.574	3.940	1.103	4.094	2.462	0.601
Propane	3.889	1.148	0.295	3.784	1.207	0.319	4.431	0.273	0.062
Butanes	6.219	0.590	0.095	5.682	0.575	0.101	6.187	0.388	0.063
Pentanes	6.813	0.174	0.026	6.731	0.156	0.023	6.629	0.134	0.020
Hexanes	11.354	0.090	0.008	10.984	0.115	0.010	10.353	0.077	0.007
Heptanes and heavier	59.184	0.063	0.001	56.216	0.098	0.002	52.941	0.067	0.001
Pressure: / Temperature:	175 lb. per sq. in. abs. 120° F.			334 lb. per sq. in. abs. 120° F.			366 lb. per sq. in. abs. 120° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K
Methane	4.257	89.277	20.970	8.365	90.730	10.846	9.071	90.951	10.023
Ethane	1.123	4.699	4.180	1.920	4.510	2.349	2.114	4.504	2.130
Propane	1.653	2.266	1.370	2.430	2.030	0.835	2.626	1.963	0.733
Butanes	3.540	1.844	0.521	4.532	1.395	0.308	4.902	1.354	0.276
Pentanes	5.572	0.999	0.179	6.183	0.695	0.112	6.282	0.682	0.109
Hexanes	11.979	0.558	0.047	11.464	0.400	0.035	11.497	0.286	0.025
Heptanes and heavier	71.876	0.357	0.005	65.106	0.240	0.004	63.708	0.261	0.004
Pressure: / Temperature:	218 lb. per sq. in. abs. 200° F.			521 lb. per sq. in. abs. 200° F.			587 lb. per sq. in. abs. 200° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K
Methane	4.747	86.321	18.190	10.765	88.195	8.193	12.087	88.429	7.316
Ethane	0.897	4.626	5.150	1.846	4.505	2.441	2.074	4.500	2.170
Propane	1.013	2.366	2.330	1.968	2.138	1.087	2.206	2.111	0.957
Butanes	2.484	2.157	0.865	3.555	1.808	0.508	3.768	1.715	0.455
Pentanes	4.158	1.542	0.371	5.198	1.217	0.234	5.296	1.085	0.205
Hexanes	9.879	1.349	0.371	10.414	0.890	0.086	10.243	1.237	0.121
Heptanes and heavier	76.852	1.639	0.021	66.254	1.248	0.019	64.327	0.924	0.014
Pressure: / Temperature:	765 lb. per sq. in. abs. 40° F.			901 lb. per sq. in. abs. 40° F.			1,123 lb. per sq. in. abs. 40° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K
Methane	23.935	94.036	3.929	26.590	94.486	3.553	31.729	94.453	2.977
Ethane	5.554	3.894	0.701	5.740	3.838	0.663	5.761	3.597	0.626
Propane	5.406	1.220	0.226	5.438	1.140	0.210	4.934	1.011	0.205
Butanes	6.537	0.529	0.081	6.348	0.494	0.078	5.606	0.531	0.095
Pentanes	6.036	0.188	0.031	5.792	0.195	0.034	5.187	0.193	0.037
Hexanes	8.739	0.069	0.008	8.399	0.108	0.013	7.315	0.108	0.015
Heptanes and heavier	43.793	0.064	41.693	41.693	0.113	0.003	39.468	0.105	0.003
Pressure: / Temperature:	486 lb. per sq. in. abs. 120° F.			840 lb. per sq. in. abs. 120° F.			1,305 lb. per sq. in. abs. 120° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K
Methane	12.552	91.469	7.287	18.656	92.701	4.969	29.683	92.775	3.126
Ethane	2.641	4.353	1.649	3.405	3.946	1.159	4.189	3.804	0.908
Propane	3.033	1.841	0.607	3.363	1.511	0.449	3.554	1.456	0.410
Butanes	5.018	1.234	0.246	4.905	0.940	0.192	4.747	0.938	0.198
Pentanes	5.993	0.558	0.093	5.501	0.418	0.076	5.103	0.453	0.089
Hexanes	10.884	0.351	0.032	9.217	0.268	0.029	8.320	0.258	0.031
Heptanes and heavier	59.880	0.193	0.003	54.954	0.215	0.004	44.403	0.316	0.007
Pressure: / Temperature:	1,040 lb. per. sq. in. abs. 200° F.			1,820 lb. per sq. in. abs. 200° F.			2,322 lb. per sq. in. abs. 200° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K
Methane	25.246	90.061	3.567	35.239	90.708	2.574	43.328	90.200	1.880
Ethane	3.020	4.094	1.355	3.819	3.927	1.028	3.856	3.770	0.964
Propane	2.672	1.773	0.663	2.864	1.689	0.590	2.835	1.630	0.580
Butanes	3.892	1.406	0.361	3.924	1.301	0.332	3.530	1.350	0.380
Pentanes	4.843	0.980	0.202	4.308	0.815	0.189	3.864	0.880	0.230
Hexanes	8.687	0.837	0.096	7.270	0.681	0.094	6.353	0.830	0.131
Heptanes and heavier	51.640	0.850	0.017	42.576	0.880	0.021	36.234	1.200	0.035
Pressure: / Temperature:	1,301 lb. per sq. in. abs. 40° F.			1,553 lb. per sq. in. abs. 40° F.			1,820 lb. per sq. in. abs. 40° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K
Methane	36.998	94.216	2.547	41.433	94.836	2.289	46.793	94.524	2.020
Ethane	5.864	3.539	0.603	4.955	3.063	0.618	4.804	3.031	0.628
Propane	4.775	1.112	0.233	3.629	0.980	0.270	3.378	1.016	0.302
Butanes	5.422	0.608	0.112	4.369	0.544	0.125	3.930	0.642	0.164
Pentanes	4.845	0.244	0.050	4.413	0.234	0.053	3.905	0.306	0.084
Hexanes	6.958	0.125	0.018	6.765	0.179	0.026	6.163	0.219	0.036
Heptanes and heavier	35.138	0.156	0.004	34.436	0.164	0.005	31.027	0.262	0.008
Pressure: / Temperature:	1,870 lb. per sq. in. abs. 120° F.			2,322 lb. per sq. in. abs. 120° F.			2,825 lb. per sq. in. abs. 120° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K
Methane	40.214	92.605	2.303	47.579	91.714	1.928	55.518	91.566	1.649
Ethane	4.301	3.590	0.835	4.307	3.517	0.817	4.331	3.178	0.734
Propane	3.180	1.374	0.432	3.024	1.367	0.452	2.722	1.350	0.496
Butanes	4.059	0.966	0.238	3.526	1.051	0.298	3.238	1.056	0.326
Pentanes	4.241	0.547	0.129	3.726	0.637	0.171	3.238	0.726	0.224
Hexanes	7.020	0.373	0.053	6.013	0.702	0.117	5.022	0.768	0.153
Heptanes and heavier	36.985	0.547	0.015	31.826	1.013	0.032	25.931	1.356	0.052
Pressure: / Temperature:	2,835 lb. per sq. in. abs. 200° F.			3,485 lb. per sq. in. abs. 200° F.			3,325 lb. per sq. in. abs. 120° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K
Methane	51.232	88.871	1.735	62.207	83.399	1.341	63.224	88.581	1.401
Ethane	4.046	3.765	0.931	4.028	4.175	1.037	4.126	3.757	0.911
Propane	2.607	1.674	0.642	2.391	1.969	0.824	2.432	1.601	0.658
Butanes	3.233	1.431	0.443	2.717	1.849	0.681	2.698	1.361	0.504
Pentanes	3.341	1.020	0.305	2.650	1.528	0.577	2.600	1.027	0.395
Hexanes	5.540	1.163	0.210	4.180	1.907	0.456	4.087	1.273	0.312
Heptanes and heavier	30.000	2.076	0.069	21.827	5.173	0.237	20.833	2.399	0.115
Pressure: / Temperature:	2,055 lb. per sq. in. abs. 40° F.			2,320 lb. per sq. in. abs. 40° F.			2,320 lb. per sq. in. abs. 40° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K
Methane	50.893	94.013	1.847	53.889	93.413	1.736	55.008	93.548	1.701
Ethane	4.667	3.054	0.654	4.440	3.030	0.682	4.410	2.934	0.665
Propane	3.131	1.088	0.348	2.960	1.127	0.381	2.878	1.058	0.368
Butanes	3.604	0.711	0.198	3.249	0.830	0.256	3.342	0.787	0.235
Pentanes	3.548	0.375	0.106	3.307	0.474	0.144	3.324	0.499	0.151
Hexanes	5.746	0.364	0.063	4.991	0.470	0.094	5.018	0.444	0.088
Heptanes and heavier	28.411	0.396	0.014	27.164	0.656	0.024	26.020	0.730	0.028
Pressure: / Temperature:	2,560 lb. per sq. in. abs. 40° F.			2,825 lb. per sq. in. abs. 40° F.			3,049 lb. per sq. in. abs. 40° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K	Liquid	Vapor	K
Methane	58.026	92.737	1.599	62.108	91.936	1.479	65.787	90.945	1.382
Ethane	4.251	3.141	0.739	4.207	3.242	0.772	3.779	3.153	0.835
Propane	2.693	1.257	0.467	2.570	1.305	0.510	2.159	1.369	0.634
Butanes	2.899	0.929	0.320	2.810	1.042	0.370	2.476	1.037	0.419
Pentanes	2.847	0.599	0.210	2.911	0.630	0.216	2.498	0.935	0.375
Hexanes	4.338	0.598	0.138	4.213	0.670	0.159	3.987	0.946	0.237
Heptanes and heavier	24.946	0.739	0.030	21.181	1.175	0.056	19.316	1.615	0.084

SWIVEL WASH PIPES



ARE A GOOD EXAMPLE

The excessive abrasion caused by drilling mud is an excellent test of COLMONOY'S abrasion resisting qualities. Tests show an increase of three to four times in the service of swivel wash pipes that have been protected with COLMONOY.

These amazing hard-surfacing alloys have made good in the petroleum industry in a big way. They come in grades for every purpose, and are easily applied by arc or acetylene welding. In addition, they may be cast. We are in position to apply and finish, or make castings from your blue prints.

Write Today for Catalog

WALL-COLMONOY CORP.

Sixth Floor, Buhl Bldg., Detroit, Mich.

625 W. Jackson Blvd. CHICAGO — 123 W. Philadelphia St. WHITTIER, CALIF.

558 W. 54th St. NEW YORK — 208 Midco Building TULSA — 3155 Seneca St. BUFFALO

COLMONOY

Hard Surfacing Alloys and Overlay Metals

BRIGHTER! SAFER!

JUSTRITE SAFETY LANTERN

Model No. 51W

APPROVED U. S. Bureau of Mines Underwriters', Labs.

Write for catalog

JUSTRITE Manufacturing Company Chicago, Ill.

TABLE 6—PHASE ANALYSES AND EQUILIBRIUM CONSTANTS FOR COMPOSITE CONTAINING 85 MOL PER CENT METHANE

Pressure: / Temperature:	583 lb. per sq. in. abs. 40° F.			1,061 lb. per sq. in. abs. 40° F.		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K
Methane	18.38	92.63	5.090	31.92	94.27	2.950
Ethane	4.01	3.29	0.820	5.01	3.12	0.623
Propane	7.19	1.78	0.250	7.24	1.59	0.220
Butanes	11.59	0.96	0.080	9.86	0.72	0.073
Pentanes	5.19	0.17	0.030	4.17	0.16	0.038
Hexanes	8.66	0.08	0.009	6.60	0.09	0.014
Heptanes and heavier	44.98	0.09	0.002	35.20	0.05	0.001
Pressure: / Temperature:	**525 lb. per sq. in. abs. 120° F.**			**1,256 lb. per sq. in. abs. 120° F.**		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K
Methane	12.54	91.74	7.320	28.36	92.40	3.26
Ethane	2.15	3.49	1.620	3.54	3.31	0.94
Propane	3.79	2.25	0.600	4.87	1.96	0.40
Butanes	7.04	1.70	0.240	7.09	1.45	0.21
Pentanes	4.13	0.34	0.088	3.60	0.31	0.087
Hexanes	8.41	0.27	0.032	6.80	0.27	0.039
Heptanes and heavier	61.94	0.19	0.003	45.74	0.29	0.006
Pressure: / Temperature:	**533 lb. per sq. in. abs. 200° F.**			**1,373 lb. per sq. in. abs. 200° F.**		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K
Methane	12.79	90.31	7.06	32.07	91.33	2.85
Ethane	1.40	3.51	2.50	2.65	3.30	1.24
Propane	2.11	2.32	1.10	3.09	2.05	0.66
Butanes	3.72	1.98	0.53	4.21	1.61	0.38
Pentanes	2.45	0.55	0.22	2.43	0.47	0.195
Hexanes	6.40	0.55	0.087	4.90	0.46	0.094
Heptanes and heavier	71.13	0.78	0.011	50.64	0.78	0.015
Pressure: / Temperature:	**1,760 lb. per sq. in. abs. 40° F.**			**2,960 lb. per sq. in. abs. 40° F.**		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K
Methane	46.88	93.30	1.990	62.24	89.76	1.440
Ethane	4.88	3.07	0.629	4.04	3.36	0.830
Propane	5.60	1.71	0.305	3.70	2.22	0.600
Butanes	6.88	1.15	0.167	4.09	1.92	0.469
Pentanes	2.91	0.26	0.089	1.46	0.51	0.349
Hexanes	4.79	0.22	0.046	3.00	0.61	0.203
Heptanes and heavier	28.06	0.29	0.010	21.46	1.62	0.076
Pressure: / Temperature:	**2,438 lb. per sq. in. abs. 120° F.**			**3,772 lb. per sq. in. abs. 120° F.**		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K
Methane	48.37	90.90	1.88	86.76	87.02	1.00
Ethane	3.99	3.30	0.83	3.39	3.42	1.01
Propane	4.14	2.06	0.50	2.39	2.38	1.00
Butanes	5.17	1.70	0.33	2.06	2.17	1.05
Pentanes	2.39	0.49	0.21	0.60	0.71	1.18
Hexanes	4.12	0.48	0.117	0.82	0.91	1.11
Heptanes and heavier	31.82	1.07	0.034	3.98	3.39	0.85
Pressure: / Temperature:	**2,764 lb. per sq. in. abs. 200° F.**			**4,086 lb. per sq. in. abs. 200° F.**		
Hydrocarbon—	Liquid	Vapor	K	Liquid	Vapor	K
Methane	46.71	89.92	1.92	87.36	87.39	1.00
Ethane	3.36	3.32	0.99	3.40	3.43	1.01
Propane	3.53	2.17	0.615	2.34	2.32	0.99
Butanes	4.08	1.87	0.458	2.03	2.01	0.99
Pentanes	1.85	0.56	0.303	0.59	0.63	1.07
Hexanes	3.69	0.63	0.191	0.92	0.87	0.95
Heptanes and heavier	36.78	1.53	0.042	3.36	3.35	1.00

Typical analyses of these composite systems are given in Table 3.

After the cell was charged and the volume of the system adjusted to the region of experimental pressure by pumping mercury into the cell, the cell was rocked at the experimental temperature for a period long enough to insure the existence of equilibrium conditions in the cell. The cell pressure decreased very rapidly to a constant value and equilibrium conditions, judged by constancy of pressure and consistency of duplicate observations, were obtained after rocking the cell for 10 to 15 minutes.

Samples of each phase were then slowly displaced from the cell by pumping in mercury. Care was exercised in maintaining the cell pressure. The samples were introduced directly into manually operated low-temperature fractionating columns.

The fractionation was carried through hexanes and the residue containing heptanes and heavier was condensed and weighed. The molecular weight of the heptanes and heavier fraction was determined by the cryoscopic method using water-saturated benzene standardized against pure iso-octane.

Experimental Results

All of the experimental data taken in this investigation with the exception of four determinations in which one of the samples was lost are recorded in Tables 4, 5 and 6 under respective headings showing the methane content of the four composites studied. Isothermal plots of the observed vaporization equilibrium constants are given in Figs. 1, 2 and 3, respectively.

Four sets of data for the 50 mol per cent methane, 33 sets for the 70 mol per cent methane, 12 sets for the 85 mol per cent methane, and 1 set for the 90 mol per cent methane composites were obtained.

The data obtained at 40° F. for the "heptane plus" show the greatest variation. This is due to the uncertainty of the analysis of the lean gas obtained at this temperature.

Discussion of Data

The curves drawn through the experimental data of Figs. 1, 2 and 3 were drawn so as to give most weight to those points for which large quantities of gas and liquid samples were taken for analysis. The curves were extrapolated in the low-pressure region to the point where the equilibrium constant equals unity at the vapor pressure

TABLE 7—PHASE ANALYSES AND EQUILIBRIUM CONSTANTS FOR COMPOSITE CONTAINING 90 MOL PER CENT METHANE

Pressure: / Temperature:	571 lb. per sq. in. abs. 40° F.		
Hydrocarbon—	Liquid	Vapor	K
Methane	17.99	92.37	5.13
Ethane	4.34	3.59	0.828
Propane	9.44	2.25	0.238
Butanes	18.59	1.56	0.084
Pentanes	6.21	0.16	0.025
Hexanes	6.89	0.06	0.009
Heptanes and heavier	36.54	0.02	0.001

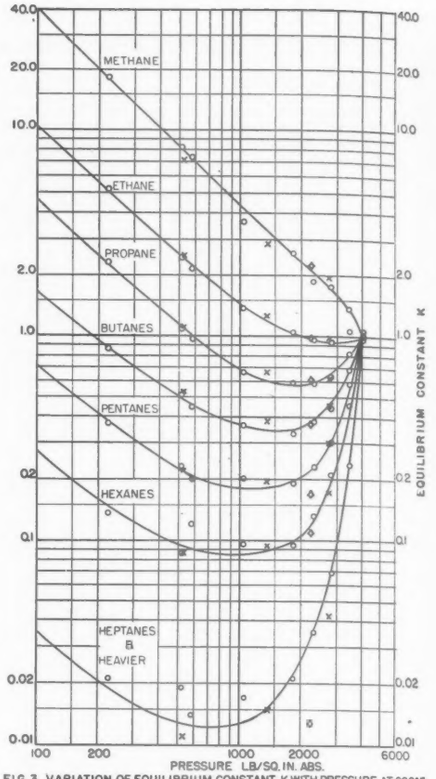


FIG. 3. VARIATION OF EQUILIBRIUM CONSTANT K WITH PRESSURE AT 200°F. DIAMONDS ARE FOR 50, CIRCLES FOR 70, & CROSSES FOR 85 MOL PER CENT METHANE IN COMPOSITE.

of the pure component. The curves were extrapolated to the critical pressure on the basis of experimental observations that set an upper and lower limit to the critical pressure. An example of a set of data used in setting up the upper pressure limit for the critical is reported in Table 6 for the pressure of 4,085 lb. per sq. in. at 200° F. This set showed that a single-phase condition existed at this pressure and the critical pressure was therefore less.

While it may not be considered conclusive so far as the C_7+ constant is concerned, the agreement of the constants for the 50, 70, 85 and 90 mol per cent methane composites for C_1 through C_6 is sufficiently good to prove that variations in composite composition have little effect on the equilibrium constants of this particular system.

Conclusion

Equilibrium constants have been presented for a gas-distillate system at temperatures of 40°, 120° and 200° F. and for pressures up to 4,000 lb. per sq. in. For this distillate and gas the equilibrium constants did not vary greatly for composites containing 50 to 90 mol per cent of methane.

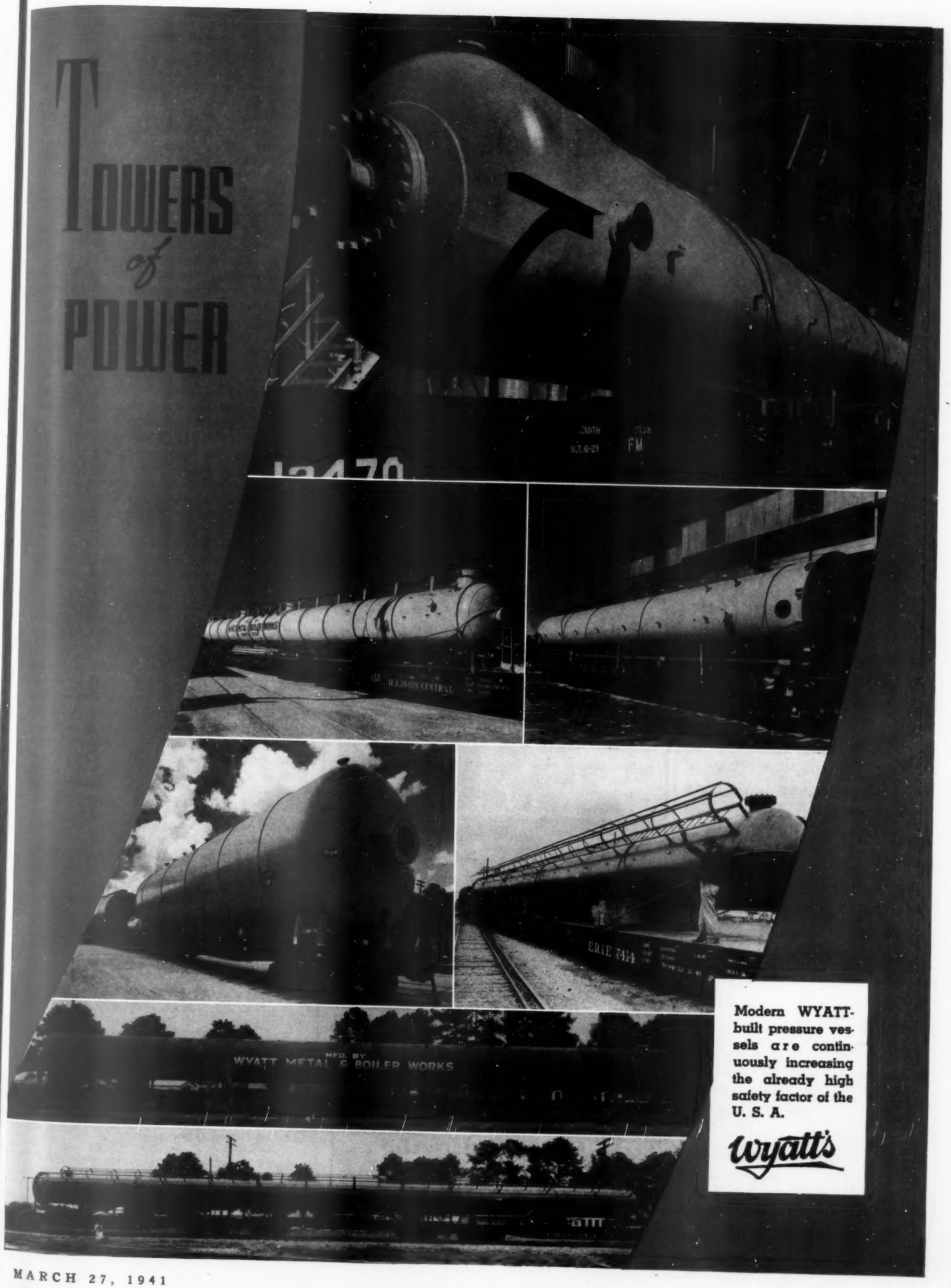
The addition of these constants to the literature and the determination of additional constants for all types and compositions of petroleum hydrocarbons should aid in the ultimate development of a general correlation of all equilibrium constants.

Acknowledgment

The assistance of members of the Phillips Petroleum Co. research department is gratefully acknowledged. The writers also wish to thank the Phillips Petroleum Co. for permission to publish these data.

Bibliography

1. Souders, Selheimer and Brown, Ind. & Eng. Chem., 24, 517 (1932).
2. Katz & Hachmuth, Ind. & Eng. Chem., 29, 1072 (1937).
3. Sage & Lacey, Numerous publications in Ind. & Eng. Chem. beginning 1934.
4. C. E. Webber, A.I.M.E. Tech. Pub. 1252 (Petr. Tech., Nov. 1940).
5. Lacey et al. See "Tentative Equilibrium Constants for Light Hydrocarbons," midyear A.P.I. meeting, Wichita, Kans., May 1938.
6. Boomer, Johnson and Argue, Can. J. Research, 15B, 367 (1937).


Towers of Power
ILLINOIS CENTRAL
ERIE 7484
MFD. BY
WYATT METAL & BOILER WORKS
Modern WYATT-built pressure vessels are continuously increasing the already high safety factor of the U. S. A.
wyatt's

Go Westwego—
and miss the Mississippi

Producers of bulk liquids west of the Mississippi can ship via New Orleans with no river-crossing charge, thanks to General American's Westwego Terminal. This modern plant brings you seven *exclusive* advantages . . . gives you complete facilities without investment on your part. Tailored to suit your needs, great or small, General American Service will save you money every day . . . every way!

ONLY GENERAL AMERICAN GIVES ALL THESE ADVANTAGES:

1. *NO CONTAMINATION.* Separate pumps, lines, storage zones for dissimilar commodities.
2. *MODERN PROTECTION.* Latest safety appliances; lowest insurance rates, minimum evaporation losses.
3. *RELIABLE CUSTODIANSHIP.* Our warehouse receipts are highest type of collateral everywhere.
4. *INDEPENDENT OWNERSHIP.* Strictest privacy; we do not buy, sell or refine any commodities.
5. *NO WHARFAGE.* There is no wharfage charge at our own private docks.
6. *SPEED WITH SAFETY.* Day and night crews, complete facilities, eliminate all shipping delays.
7. *WORLD'S LARGEST TANK CAR FLEET.* One car or hundreds, wherever and whenever needed.

GATX GENERAL AMERICAN

Strategically located to serve you!

GENERAL AMERICAN TANK STORAGE TERMINALS

Goodhope, La. and Westwego, La., (Port of New Orleans)
Corpus Christi, Texas
Carteret, N. J. (Port of New York) Galena Park, Texas (Port of Houston)

A DIVISION OF GENERAL AMERICAN TRANSPORTATION CORPORATION

Chemistry in Petroleum Refining

(Continued from Page 86)

Before entering into the discussion of naming hydrocarbons, it is necessary to know the names of certain "radicals" or "groups." The following table shows the formula and names of a few of the simplest radicals compared with the formula and name of corresponding hydrocarbons:

RADICAL		HYDROCARBON	
CH_3-	METHYL	CH_4	METHANE
CH_3CH_2-	ETHYL	CH_3CH_3	ETHANE
$CH_3CH_2CH_2-$	N-PROPYL	$CH_3CH_2CH_3$	PROPANE
$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}-$	ISOPROPYL	$CH_3CH_2CH_3$	PROPANE

It will be noted that the formula of the radical is obtained by removing a hydrogen atom from the formula of the corresponding hydrocarbon. In the case of propane it is possible to remove a hydrogen atom from one of the end carbon atoms or from the middle carbon atom, thus giving rise to two radicals—the *n*-propyl and the isopropyl, respectively. It should be understood that it is impossible actually to remove one hydrogen atom from a hydrocarbon to make a radical inasmuch as radicals do not exist as entities in nature. In other words, radicals such as methyl, ethyl, etc., are only combinations of atoms taken as a unit which are useful for naming purposes or synthesis. By comparing the names of the hydrocarbons and radicals, it will be found that the names of the radicals are obtained by replacing the "ane" at the end of the name of the hydrocarbon by "yl."

In naming organic compounds where a radical appears more than once in the formula, suitable prefixes such as di, tri, tetra, etc., are placed in front of the name of the radical to show the number of times the radical appears in the formula. For example, dimethyl means that there are two methyl groups present; trimethyl, that there are three present, etc.

In general, the substitution system of naming organic compounds consists of taking some central section of the molecule as a nucleus and constructing a name composed of the names of the radicals attached to the nucleus and the name of the nucleus. For example, a member of the paraffin hydrocarbon series,

$$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle |}{C}}}}-CH_2CH_3$$

would be called trimethyl ethyl methane. Thus, if this compound were built up from methane, there would be three methyl groups (CH_3—) and one ethyl group (CH_3CH_2—) attached to the carbon atom originally contained in the methane. The following examples further illustrate this type of naming with paraffin hydrocarbons.

$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle |}{CH}}}}-CH_3$ – TRIMETHYL METHANE

$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle |}{C}}}}-CH_3$ – TETRAMETHYL METHANE

$CH_3CH_2-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle |}{C}}}}-CH_2CH_3$ – DIETHYL DIMETHYL METHANE

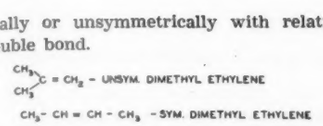
With olefin hydrocarbons the substitution system is similar to that used in the paraffins except that the nucleus chosen is always the two-carbon atoms containing the double bond which is called ethylene. For example:

$CH_3-\overset{\displaystyle CH_2}{\overset{\displaystyle ||}{CH}}$ – METHYL ETHYLENE

$CH_3CH_2-\overset{\displaystyle CH_2}{\overset{\displaystyle ||}{CH}}$ – ETHYL ETHYLENE

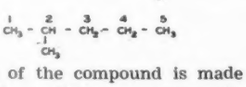
In such cases where there are two groups attached to the ethylene nucleus the abbreviations *sym* or *unsym* are attached to the name to indicate whether the radicals are placed sym-

metrically or unsymmetrically with relation to the double bond.

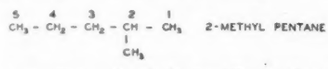


The substitution system of naming works well with simple compounds. However, with compounds of complex structure it fails or becomes very unwieldy. The Geneva system, developed in 1892 at a conference of organic chemists at Geneva, Switzerland, is far more complete and is the standard method of naming used in most scientific periodicals.

With paraffin hydrocarbons, the Geneva system of naming operates as follows: (1) The longest main chain of carbon atoms is numbered beginning at that end of the chain which will give the lowest possible number to the side chain. Example:

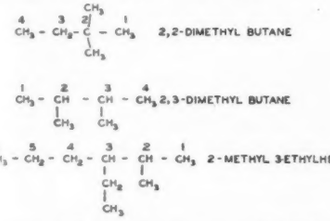


(2) The name of the compound is made up by first naming the radicals or groups attached to the main chain with a number in front of each to indicate the position of the radical on the main chain. This is followed by a name for the main chain which indicates the length of the chain and the type of hydrocarbon. For example:

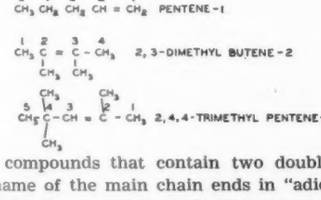


In this case the main chain has five carbon atoms and its share of the name is pentane—the "pent" indicating five carbon atoms and the "ane" indicating a member of the paraffin series.

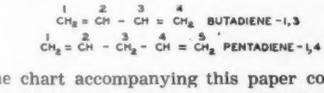
Other examples show the use of this system in somewhat more complicated cases:



The use of the Geneva system with olefin hydrocarbons is much the same as with the paraffins except that the name of the main chain, which should always contain the double bond, ends in "ylene" or "ene" (the latter ending is preferred) followed by a number to indicate the position of the double bond. For example:

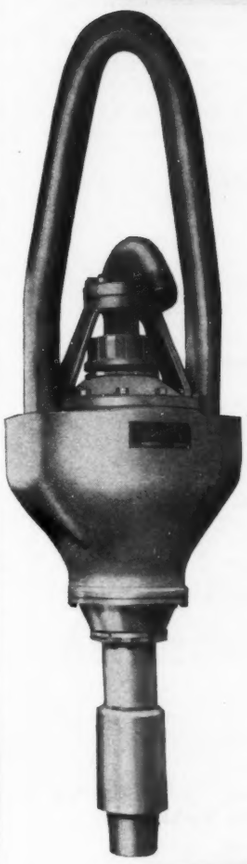


In compounds that contain two double bonds the name of the main chain ends in "adiene" followed by two numbers indicating the position of the two double bonds:



The chart accompanying this paper contains a table which summarizes the two systems of naming paraffin and olefin hydrocarbons as compared to general or nonsystematic names.

In the following sections the chemistry of the new processes described in "Petroleumization—1940" is discussed by means of equations. This has been written with the intention of supplementing Mr. Field's article and should be used in conjunction with it. It should also be pointed out that the examples used in this discussion are illustrated with a few simple compounds and so the actual application of the process to the mixture



Quality!
Precision!
Capacity!
Streamlined Appearance!

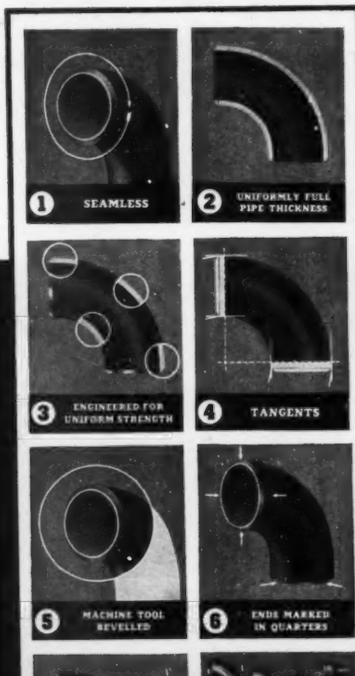
Here is a drilling swivel that has everything. A clear, unobstructed fluid channel. Maximum strength. Minimum weight. Free floating heat-treated stem mounted on three sets of heavy-duty roller bearings running in an oilbath. Chrome-Moly steel body and bonnet. 4" and 6" sizes. 150 ton, 250 ton and 300 ton capacities. (Also 3" size for shallow drilling.) For complete specifications refer to Composite Catalog or write for catalog on .....

BREWSTER
Oilbath
SWIVELS

Manufactured and Sold by

The BREWSTER CO., Inc.
SHREVEPORT, LA.
Branches at New Iberia and Houma

TAYLOR FORGE


1 SEAMLESS
2 UNIFORMLY FULL PIPE THICKNESS
3 ENGINEERED FOR UNIFORM STRENGTH
4 TANGENTS
5 MACHINE TOOL BEVELLED
6 ENDS MARKED IN QUARTERS
7 COMPLETE IDENTIFYING MARKS ON EVERY FITTING
8 A FULL LINE

EVERY one of these eight features plays a part in making your pipe welding jobs quicker, easier, better. WeldELLS alone offer all eight.

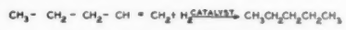
TAYLOR FORGE & PIPE WORKS
General Offices & Works: Chicago, P. O. Box 485
New York Office: 50 Church St.
Philadelphia Office: Broad Street Station Bldg.

WeldELLS
Seamless Pipe Fittings for Welding

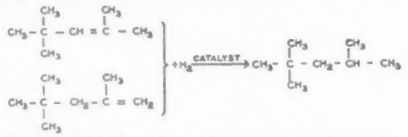
occurring in petroleum fractions is considerably more complicated. Each process is also complicated by the fact that under the conditions of plant operation more than one type of reaction may take place. For example, in a thermal polymerization plant under the operating conditions used, some alkylation, as well as polymerization, may take place.

1. Hydrogenation.

(*a*) Nondestructive.



Net result: Conversion of olefin to paraffin of same molecular size. Catalysts commonly used for this type of hydrogenation are nickel, platinum, molybdenum oxide or sulfide, chromium oxide, nickel oxide, cobalt oxide and several others. A specific example of nondestructive hydrogenation used in the petroleum industry is the hydrogenation of diisobutylene, produced by the selective polymerization of isobutylene, to isooctane.



Note.—"Diisobutylene" is a mixture of the above olefins.

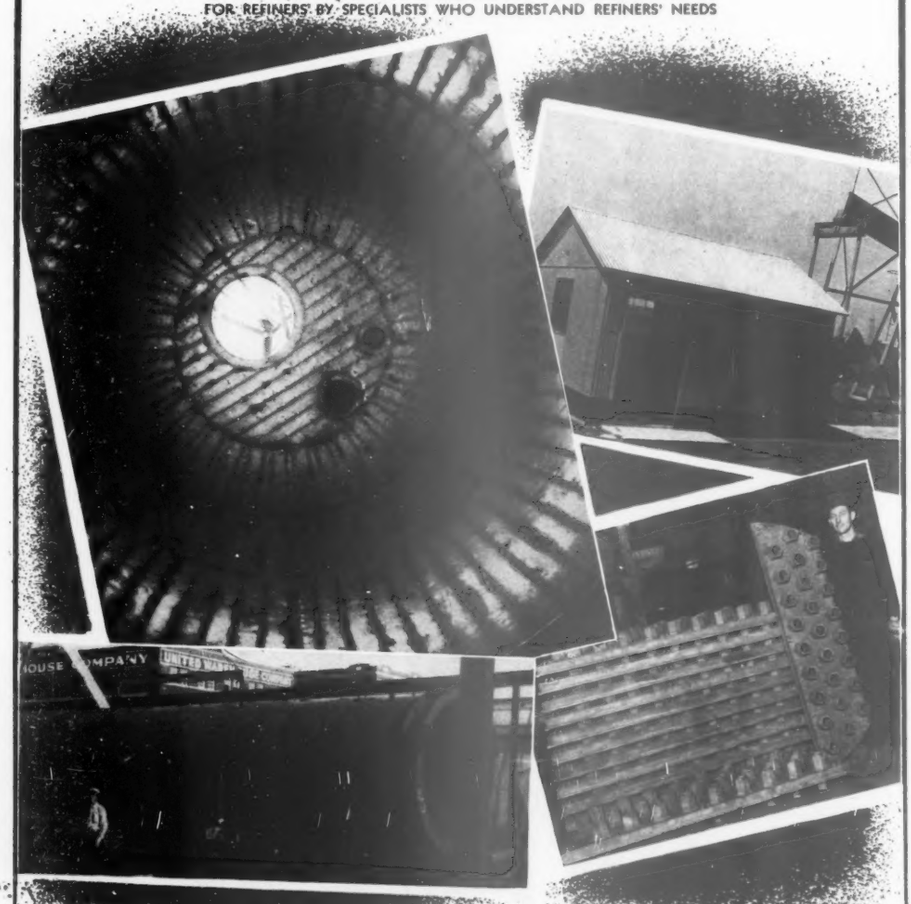
WATKINS Inc.

STEEL • CAST IRON • HEAVY HARDWARE

SPECIALIZING IN REFINERY STEEL FABRICATION

• STAINLESS STEEL BUBBLE TRAYS AND CAPS
• CAST IRON BUBBLE TRAYS AND CAPS
• SECTIONAL STEEL BUILDINGS • FABRICATED STEEL BUILDINGS
• ELECTRIC WELDED VESSELS • FABRICATED STEEL
• SMOKE STACKS • BREECHINGS AND DUCTS
• CONDENSER BOXES • LOADING RACKS • LADDERS AND WALKWAYS

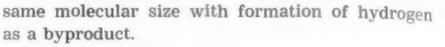
WE SOLICIT INQUIRIES REGARDING THE ABOVE PRODUCTS... MADE FOR REFINERS BY SPECIALISTS WHO UNDERSTAND REFINERS' NEEDS



Address WATKINS INC. Dept. R

710 EAST FIRST STREET • WICHITA, KANSAS • PHONE 4-7301, L. D. 80

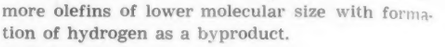
(*b*) Destructive.



Net result: Conversion of paraffin to two or more paraffins of lower molecular size.

2. Dehydrogenation.

(*a*) Nondestructive.



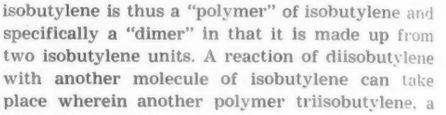
Net result: Convension of paraffin to olefin of same molecular size with formation of hydrogen as a byproduct.

(*b*) Destructive.

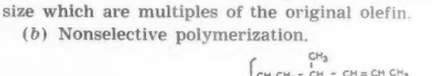
Net result: Conversion of paraffin to two or more olefins of lower molecular size with formation of hydrogen as a byproduct.

3. Polymerization.

(*a*) Selective polymerization.

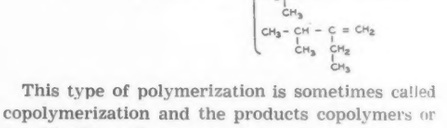


In polymerization of isobutylene to diisobutylene, two isomeric octenes are formed which differ only in position of the double bond. Diisobutylene is a mixture of 80 parts 2,4,4-trimethyl pentene-1 and 20 parts 2,4,4-trimethyl pentene-2. Diisobutylene is thus a "polymer" of isobutylene and specifically a "dimer" in that it is made up from two isobutylene units. A reaction of diisobutylene with another molecule of isobutylene can take place wherein another polymer triisobutylene, a trimer, is formed.



Net result: Linking of two or more like olefin molecules to make olefins of greater molecular size which are multiples of the original olefin.

(*b*) Nonselective polymerization.

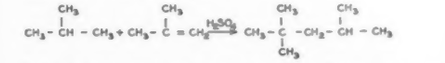


This type of polymerization is sometimes called copolymerization and the products copolymers or specifically codimers, cotrimers, etc. In addition to the number of codimers listed above it should be emphasized that the product of a polymerization of butene-1 and propylene will also contain polymers of butene-1 reacting with itself and polymers of propylene reacting with itself. In nonselective polymerization as carried out in the plant a mixture of isobutylene, butene-1 and butene-2 is used. It will be readily understood that the product produced is of tremendous complexity.

Net result: Linking of two or more unlike olefins to make a complicated mixture of olefins of greater molecular size than the original reactants.

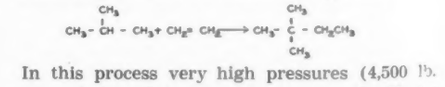
4. Alkylation.

Sulfuric acid process.

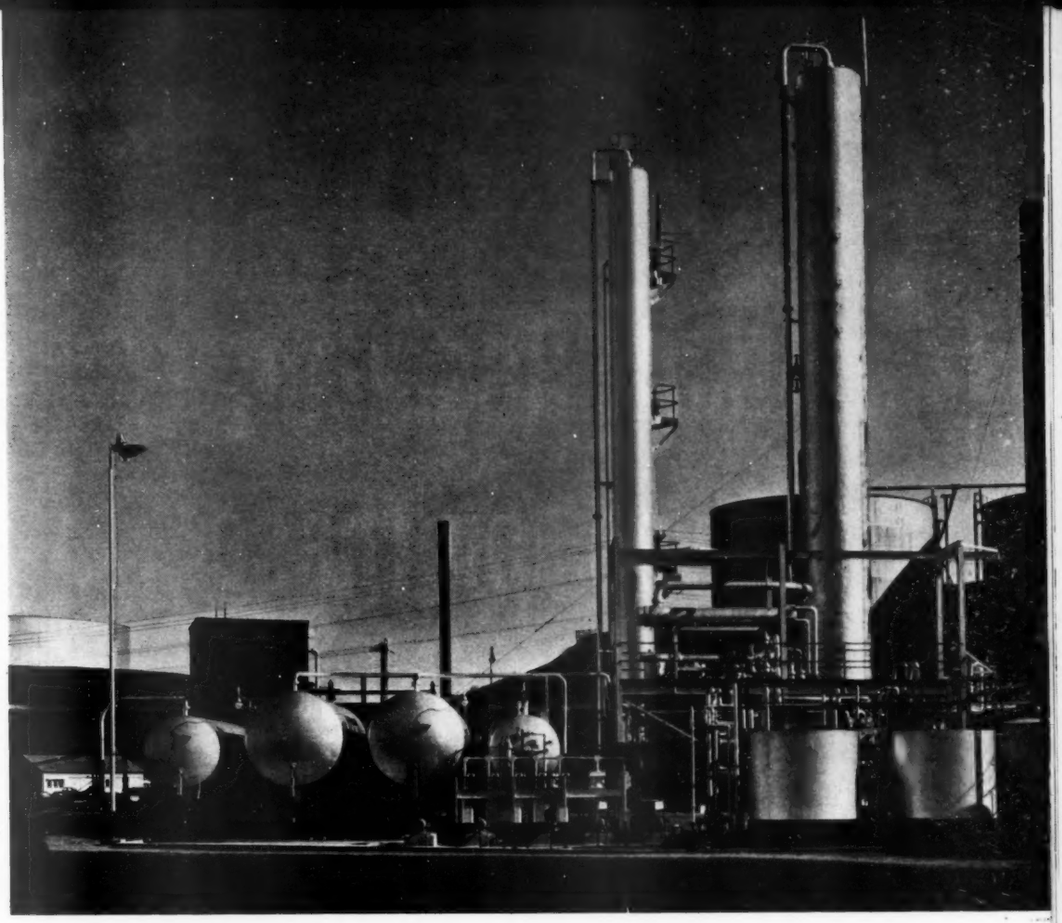


In this process, isobutane must always be used but other olefins beside isobutylene may be used.

Phillips Petroleum Co. neohexane process:



In this process very high pressures (4,500 lb. per sq. in.) and temperatures are used. Under these conditions it is possible to use paraffins other than isobutane. For example, the Phillips



SOLUTIZER

GASOLINE REFINING PROCESS

Complete removal of mercaptans with sulphur reduction

1. Lead response greatly improved; clear octane number often raised . . . Straight run, cracked and reformed gasolines rendered doctor sweet by simple extraction.

2. Enhances anti-knock value of gasolines—raises marginal gasolines to octane number specification without exceeding lead limits . . . Pays out in remarkably short time.

3. Three plants in commercial operation processing 35,000 barrels per day . . . In course of construction by Foster Wheeler Corporation—28,000 barrels per day. Solutizer units engineered and constructed by Foster Wheeler under patents of the Shell Development Company.

FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK, N.Y.

FOSTER WHEELER

Alkali Desalting Gives You These Advantages:

1. Reduces Hydrochloric Acid *CORROSION*

2. Crude oil charged *DIRECT* to still

3. Lowers operating *COSTS*

It will pay you to investigate recent improvements in desalting crude oils with Solvay Alkalies.

60th ANNIVERSARY 1881 • 1941

LICENSERS OF CAUSTIC SODA MERCAPTAN REMOVAL PROCESS

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 Rector Street . . . . New York, N. Y.

BRANCH SALES OFFICES:

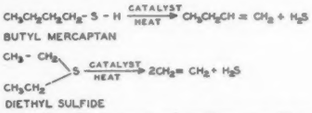
Boston • Charlotte • Chicago • Cincinnati • Cleveland • Detroit
New Orleans • New York • Philadelphia • Pittsburgh • St. Louis • Syracuse

Plants Located At: Syracuse, N. Y. • Detroit, Mich. • Baton Rouge, La. • Hopewell, Va.

Petroleum Co. makes isopentane as a byproduct in its process due to the following reaction:

Net result of alkylation: Reaction of a paraffin with an olefin to make a paraffin of molecular size equal to the sum of the two reactants.

5. Catalytic desulfurization.



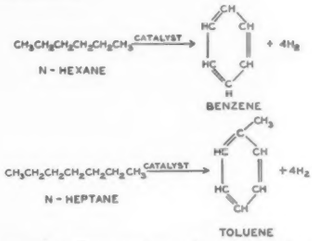
Net result: Removal of sulfur as H_2S forming olefin hydrocarbons as a byproduct.

6. Isomerization.

Recent experimental work has shown that isomerization of paraffins can be accomplished by use of $AlBr_3$ and $AlCl_3$, but as yet there is no commercial process as far as the author is aware. From the very nature of isomerization it would appear that the conditions for this reaction must be very close to those of cracking.

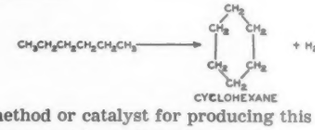
Net result of isomerization: Conversion of straight-chain paraffins to branched-chain paraffins.

7. Aromatization.



Net result: Conversion of straight-chain paraffins into aromatic hydrocarbons with formation of large amounts of hydrogen as a byproduct.

8. Cyclization.



A method or catalyst for producing this reaction has not as yet been discovered.

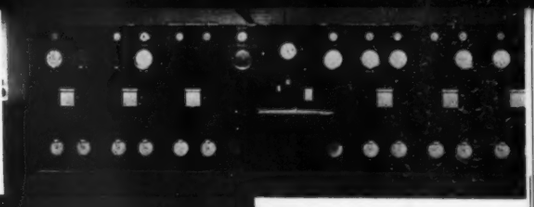
Net result of cyclization: Conversion of paraffin hydrocarbons into cyclic hydrocarbons.

A.S.T.M. Issues Manual On Refractory Materials

Refiners interested in choosing refractory materials to the best advantage will be interested in the latest manual of the American Society for Testing Materials designed for plant use.

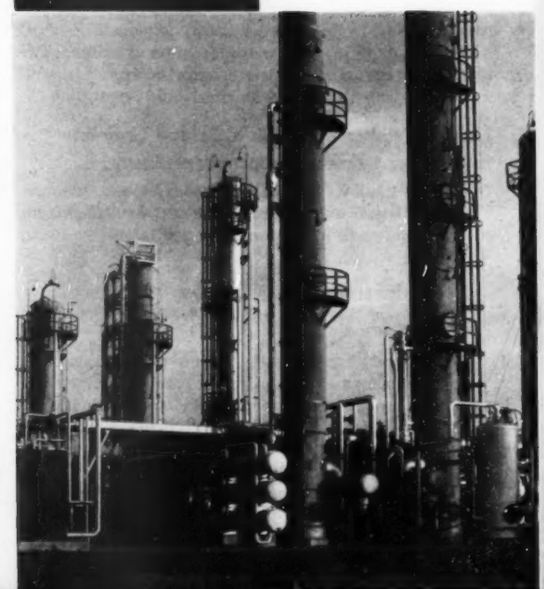
The 15 standardized testing procedures, comprising a major portion of the publication, cover such subjects as pyrometric cone equivalent, panel test for resistance to thermal and structural spalling of refractory brick, permanent linear change, load test, cold crushing strength, warpage, porosity, particle size of ground materials, and methods of chemical analysis. Also given is a recommended procedure for calculating heat losses through furnace walls.

One of the activities of the society's Committee C-8 which sponsors this manual has been the development of industrial surveys of refractory service conditions. There is now a total of nine included. The 65 pages devoted to these surveys incorporate a wealth of technical information. The surveys cover the following: Open-hearth practice, malleable iron, copper, and lead industries, byproduct coke ovens, lime burning, glass, and portland-cement industry, and stationary steam boilers. Another feature of the compilation is information on standard samples of refractory materials, some eight standard samples being covered. Complete with an index, copies of this 180-page manual can be obtained from A.S.T.M. headquarters, 260 South Broad Street in New York City, at $1.50 in board cover.



BUILT THESE TOO

We design, engineer and build recycling and pressure maintenance plants, skimming plants, cracking plants, natural gasoline absorption and stabilization plants, vapor recovery plants, and compressor stations—independently or in collaboration with the customer's staff engineers. ¶ Credit outstanding results over the last five years with our reputation for speed, economy and efficiency in this field now so important to national defense. Credit, too, our close contact with the nation's foremost material sources, rooted in thirty-three years of construction work for the Petroleum Industry. ¶ Call it a trend, if you will, but whatever it is, it's to Frick-Reid.



FRICK-REID

Supply Corporation

TULSA, OKLAHOMA

Turner Valley Natural Gas and Crude Oils—a refinery evaluation

By DAVIS READ, JR., and GUSTAV EGLOFF
Research Laboratories, Universal Oil Products Co.

The Turner Valley field in Alberta, Canada, is a potential source of immense volumes of natural gas and crude oil. The 1940 production of oil and gas was about 8,000,000 bbl. of crude oil and 36,000,000,000 cu. ft. of natural gas. For the year 1941 the production is at the rate of 10,000,000 bbl. of crude a year.

As scientific and technical developments increase, it becomes more and more desirable to know what the hydrocarbons and their percentages are in natural gas and crude oils. Studies have been made of the composition of Turner Valley gas and crude oil. Typical samples of natural gas taken from Turner Valley show the following hydrocarbon analyses:

TABLE 1—TYPICAL ANALYSES OF TURNER VALLEY GAS

	Percentage volume	Percentage volume
Methane plus*	84.18	87.77
Ethane	8.95	5.85
Propane	4.30	3.76
Isobutane	0.63	0.74
n-Butane	1.09	0.99
Isopentane	0.36	0.29
n-Pentane	0.17	0.31
Hexanes and heavier	0.32	.029

*Includes nitrogen, helium and other nonhydrocarbon gases insoluble in caustic soda.

Natural gasoline per 1,000 cu. ft. of gas approximates 0.35 gal. of 20-lb. per sq. in. Reid vapor pressure with an analysis as indicated in Table 2.

TABLE 2—NATURAL GASOLINE

	Percentage liquid volume	Percentage weight
Butane	20.44	18.42
Isopentane	35.12	34.04
n-Pentane	11.15	10.93
Hexanes and heavier	33.29	36.61

A.S.T.M. Distillation

Gravity	85.6 °F.
Initial	66
Per cent distilled over:	
5	73
10	77
20	82
30	87
40	94
50	102
60	112
70	125
80	144
90	182
Endpoint	296

In view of the commercial processes which convert butanes to high-octane gasoline, a part of this study is concerned with their application in utilizing the large amounts of butane available at the Turner Valley field.

Emphasis might also be placed upon the high percentages of isopentane present in the natural gasoline. Isopentane has an octane rating of 91 and is highly suitable for aviation gasoline. The normal pentane, which has an octane rating of 64, may readily be isomerized into isopentane.

Production of High-Octane Gasoline From Hydrocarbon Gases

The total volume of butane available from the natural gas and cracked gases (resulting from cracking-plant operation discussed later) are listed below:

NORMAL AND ISOBUTANE AVAILABLE

Natural gas	75,500,000 gal. per year
Cracked gas	45,500,000 gal. per year

The existing natural-gasoline plants operating to produce a debutanized natural gasoline and maximum butane absorption in conjunction with a gas-concentration system would make available a large part of the butanes present. These butanes could be readily processed to produce high-octane gasoline for motor-car or aviation use by any one of the following systems of processes now available to the refiner:

1. Pyrolysis of the total butanes followed by nonselective polymerization.
2. Catalytic dehydrogenation of the total butanes followed by selective polymerization and hydrogenation.
3. Prefractionation of the butanes followed by catalytic dehydrogenation of the normal butane; then alkylation of the isobutane by the resulting olefins.
4. Polymerization of olefins in cracked gases from cracking heavy oils, reforming of gasoline, cracking, or catalytic dehydrogenation of propane, butanes.

The selection of one or more of these combinations of processes would depend on a careful consideration of the type of gasoline desired.

Suggested combinations of Nos. 2 and 3 would be expected to yield 78 weight per cent of 95-100-octane-number gasoline useful for high-octane aviation-fuel blends. The potential yield of 95-100-octane aviation fuel from this field using the combination No. 2 is estimated to be 5,000 bbl. per day. Combination No. 1, which is being used by the Shamrock Oil & Gas Corp. at Amarillo, Tex., in conjunction with its natural-gasoline plant, produces a nonselective propylene and butylene polymer which is mixed directly with cracked gasoline to increase its octane number.

The Turner Valley crude studied in this report was analyzed as shown in Table 3 to determine the percentages of light hydrocarbons present.

TABLE 3—LIGHT HYDROCARBONS IN TURNER VALLEY CRUDE

	Per cent
Ethane	0.12
Propane	0.99
Isobutane	1.21
n-Butane	1.72
Isopentane	1.88
n-Pentane	1.96

A fine study of the components above butane present in Turner Valley crude was made by Watson and Spinks.[1] Their results are given in Tables 4, 5, and 6.

These analyses and conclusions parallel work done at the National Bureau of Standards. Table 4 shows a rough approximation of the classes of hydrocarbons present in several narrow boiling fractions of the Foundation well No. 1 crude oil. Two different methods of analysis were used.

Tables 5 and 6 show a more exact analysis of

[1]Watson, L. M., and Spinks, J. W. T., Canadian J. Res. 18, Sec. B, pp. 388-404 (1940).

TABLE 6—COMPOUNDS BOILING BETWEEN 80° AND 153° C.

Compound—	Est. crude composition—volume per cent: Foundation well No. 1	Sterling Pacific No. 3
Dimethylcyclopentane	0.71	0.75
2-Methylhexane	0.90	1.0
3-Methylhexane	0.60	0.7
n-Heptane	1.40	1.6
Methylcyclohexane, Ethylcyclopentane	0.90	2.2
Toluene	1.07	2.0
2-, 3-, and 4-Methylheptane	0.55	0.5
Dimethylcyclohexanes	0.50	0.8
n-Octane	1.00	0.95
Ethylcyclohexane	0.65	0.6
Threexylenes, Ethylbenzene	1.45	2.5
n-Nonane	0.80	0.8

TABLE 4—ESTIMATED COMPOSITION OF HEMPEL SAMPLES

Sample No.—	Kurtz and Headington method: Paraffins	Naphthenes	Aromatics	Tizard and Marshall method: Paraffins	Naphthenes	Aromatics
1	100	...	...	...	...	...
2	85.6	14.4	...	78	22	...
3	65.0	28.6	6.4	51.3	37.6	11.1
4	46.8	43.3	9.9	48.6	32.3	19.1
5	53.4	29.3	17.3	50.5	27.2	22.3
6	41.2	38.8	20.0	55.8	21.7	22.5
7	38.2	43.3	18.5	46.1	36.7	17.2
8	29.6	52.8	17.6	45.6	40.5	13.9

TABLE 5—COMPOUNDS BOILING BELOW 81° C.

Compound—	Boiling point, °C. at 760 mm.	Estimated crude composition—volume per cent: Foundation well No. 1	Sterling Pacific No. 3
Isopentane	28.0	0.36	0.38
n-Pentane	36.0	0.90	0.79
Cyclopentane	49.5	0.14	0.09
2,2-Dimethylbutane	49.7	0.14	0.11
2,3-Dimethylbutane	58.1	0.25	0.27
2-Methylpentane	60.2	0.80	0.94
3-Methylpentane	63.2	0.44	0.56
n-Hexane	68.7	1.30	2.40
Methylcyclopentane	72.1	0.55	0.82
Benzene	80.2	0.28	0.32
Cyclohexane	80.8	0.41	0.76

TABLE 7—PROPERTIES OF TURNER VALLEY CRUDE OIL, TOPPED AND REDUCED CRUDES

Sample:	Crude oil				Topped crude	Reduced crude
Gravity, °A.P.I.	44.0		43.1		31.8	27.9
Specific gravity at 60° F.	0.8063		0.8104		0.8665	0.8877
Sulfur, per cent	0.24		0.32		0.41	0.56
B.s. and w., per cent	....		0.1		0.5	0.1
Cold test, °F.	....		5		45	75
Flash, Pensky-Martens, °F.	....		....		155	135
Universal viscosity at 100° F., seconds	....		....		....	108
Salt as sodium chloride, lb./1,000 bbl.	Trace		2			
Characterization factor	....		....		11.88	11.90
100-cc. distillation:	Atmospheric			Vacuum	Atmospheric	Vacuum
Initial, °F.	112	129	365	382	320	272
5 per cent	170	170	460	459	508	497
10 per cent	204	198	477	482	553	546
20 per cent	263	255	507	508	609	617
30 per cent	314	312	533	528	645	662
40 per cent	374	375	561	568	677	700
50 per cent	437	450	597	610	705	740
60 per cent	511	521	641	660	728	778
70 per cent	579	594	683	716	739	814
80 per cent	654	687	735	785	753	859
90 per cent	722	760+	760+	870	760+	914
End point, °F.	736	760+	760+	977	760+	1002
Per cent over	99.0	98.5	98.5	96.0	98.4	97.0
Per cent bottoms	....	....	....	4.0	....	3.0
Per cent coke by weight	1.0	1.1	1.2	....	1.6	....
Per cent at 400° F.	44.0	43.0	trace	....	trace	....
Per cent at 572° F.	69.0	67.5	43.5	....	13.5	....

the actual compounds present and give comparisons between two Turner Valley crudes, Royalite Oil Co. 3 Sterling Pacific well, and Foundation well No. 1 located in the southern part of Turner Valley.

Table 6 is less exact in its percentages, since the number of isomeric compounds in this boiling range is greater and close fractionation is difficult. The authors state that the compounds present in larger amounts are more accurately given than those in small quantities.

It is interesting to note the percentages of low-boiling aromatic hydrocarbons present in the Turner crude, such as benzene 0.28 per cent, toluene 1.07 per cent, and xylenes-ethylbenzene 1.45 per cent.

Refining Characteristics

Two samples of Turner Valley crude oil and samples of topped and reduced crude prepared in the semicommercial and commercial distillations of the crude were each subjected to laboratory inspection as shown in Table 7. The two crude samples differ slightly in properties, the heavier sample containing 1.0 per cent less at 400° F. by Engler distillation. The sulfur contents of the two crude oils were 0.24 per cent and 0.32 per cent and the salt contents were very low. The crude oils were also evaluated in several breakups using a 10-in. laboratory Hempel column for fractionation. The detailed results of these tests are presented in Table 8.

Turner Valley crude oil is a relatively light oil containing approximately 47 per cent of 400° F. end-point gasoline having a motor-method octane number of 53-54. Decreasing the end point of the gasoline to 248° F. increases the octane number to 68. The octane numbers of the light straightrun fractions would be sufficiently high to permit the use of these fractions in aviation-gasoline blends, after sweetening. Although the total sulfur contents of the straightrun gasolines are low, the percentage of mercaptan sulfur is unusually high and represents over 75 per cent of the total sulfur present. Further fractionation of the crude oil produces 26.8 per cent gas oil with a cold test of —15° F. This gas oil should be suitable for use as fuel in a medium or high-speed diesel engine since it is estimated that the cetane number of this material would be approximately 50.

The 43.1° A.P.I. crude, the 31.8° A.P.I. topped crude and the 27.9° A.P.I. reduced crude were each subjected to cracking tests in a Dubbs pilot plant in order to evaluate them as cracking stocks. The tests on the whole crude were conducted to produce a blend of straightrun and cracked gasoline, gas, and residuum in a simultaneous topping and cracking operation. Tests were made on both the topped and reduced crude to produce cracked gasoline, gas and residuum. In addition, the topped crude was processed to produce gasoline, 628° F. end-point side-cut "gas" oil, residuum, and gas. Table 9 presents the results of these tests. A yield of 82.0 per cent of combined straightrun and cracked gasoline was obtained when processing the whole crude, and this gasoline, which has a motor-method octane number of 64, is composed of approximately 58 per cent straightrun and 42 per cent cracked gasoline. When cracking the topped crude a yield of 63.1 per cent gasoline having an octane number of 68.5 was obtained, and when simultaneously withdrawing 16.1 per cent of 628° F. end-point side-cut oil, the gasoline yield was 54.9 per cent. The reduced crude produced 59.8 per cent of 70-octane-number gasoline having a Reid vapor pressure of 13.4. Several additional tests on this stock showed that the 400° F. end-point cracked gasolines produced have an octane number of 68.5 when the Reid vapor pressure is approximately 10.0 lb. per sq. in.

The cracked residuums are comparable to an S.C.-2 grade road oil according to specifications recommended by the Asphalt Institute. This is a very slow-curing liquid product suitable for use in dry climates during cool weather as a road mix in which the mineral aggregate is densely graded. The cracking operation can be controlled to produce various quality residuums which might be used directly as medium or slow-curing road oils with a small quantity of light oil to produce various grades of rapid-curing road oil. The cracked residuums also meet the customary specifications for A.S.T.M. Grade No. 6 fuel oil. A fuel oil of this quality is best suited for use in burners equipped with preheaters such as those used under locomotive and steamship boilers and in stationary commercial furnaces.

The cracked side-cut oil produced in processing the topped crude would be suitable for use as fuel in a low-speed diesel engine or blended with a straightrun fraction for use in a medium or high-speed diesel. The side-cut oil was also fractionated in a laboratory Hempel column to pro-

TABLE 8—LABORATORY EVALUATION OF TURNER VALLEY CRUDE OIL

	°A.P.I. gravity of crude sample				
	44.0				43.1
Breakup number	1	2	3	4	5
Yields, volume per cent of crude:					
250° F. end-point gasoline	21.7	21.7	....	....	....
250-400° F. naphtha	....	25.6	....	....	....
400° F. end-point gasoline	....	....	47.5	47.5	47.0
Gas oil	....	....	....	26.8	....
Topped crude	77.4	51.8	51.8	....	52.5
Reduced crude	....	....	....	25.0	....
Recovery	99.1	99.1	99.3	99.3	99.5
Loss	0.9	0.9	0.7	0.7	0.5
Properties of distillates:	250° F. end-point gasoline	250-400°F. naphtha	400°F. end-point gasoline	Gas oil	400° F. end-point gasoline
Gravity, °A.P.I.	72.8	49.1	58.8	37.2	59.0
Specific gravity at 60° F.	.6926	.7836	.7436	.8388	.7428
Total sulfur, per cent	0.11	0.14	0.13	0.20	0.10
Mercaptan sulfur, per cent	0.09	0.12	0.10	....	0.08
Octane No., motor method	68	41	53	....	54
Vapor pressure, Reid, lb.	12.0	....	8.0	....	....
Cold test, °F.	....	....	....	—15	....
Universal viscosity at 100° F., sec.	....	....	....	36	....
Kinematic viscosity at 100° F., cs.	....	....	....	2.66	....
Characterization factor	12.34	11.72	12.00	11.77	11.98
100-cc. distillation:					
Initial, °F.	78	259	93	425	100
5 per cent	102	272	132	444	141
10 per cent	114	278	153	454	161
20 per cent	130	283	188	466	192
30 per cent	146	291	217	477	218
40 per cent	160	302	241	486	239
50 per cent	173	312	262	500	260
60 per cent	184	322	283	512	279
70 per cent	194	333	305	529	300
80 per cent	206	349	324	541	325
90 per cent	221	370	358	570	363
End point, °F.	248	407	400	607	400
Per cent over	95.5	99.0	98.0	99.0	98.0
Per cent bottoms	1.0	1.0	1.0	1.0	1.0
Per cent loss	3.5	....	1.0	....	1.0
Properties of residue:		Topped crude	Topped crude	Reduced crude	Topped crude
Gravity, °A.P.I.		37.1	32.1	27.0	31.0
Specific gravity at 60° F.		.8393	.8649	.8927	.8708
Sulfur, per cent		....	0.36	0.62	0.54
B.s. and w., per cent		0.05	0.1	0.2	0.2
Cold test, °F.		15	50	80	45
Flash, Pensky-Martens, °F.		....	220	355	220
Universal viscosity at 100° F., sec.		38.5	52.9	144	54.6
Characterization factor		11.90	11.90	11.90	11.87
100 cc. distillation:					
Initial, °F.		281	446	613	450
5 per cent		313	470	635	472
10 per cent		329	488	646	484
20 per cent		368	510	661	507
30 per cent		405	531	674	540
40 per cent		462	560	686	572
50 per cent		516	595	703	610
60 per cent		567	637	713	655
70 per cent		630	686	724	700
80 per cent		688	718	733	734
90 per cent		732	738	748	753
End point, °F.		747	742	749	760+
Per cent over		99.0	98.5	98.0	98.0
Per cent coke by weight		1.0	1.4	2.2	2.1
Per cent at 572° F.		....	43.5	....	40.0

TABLE 9—CRACKING RESULTS, DUBBS PILOT PLANT

	Charging stock			
	43.1° A.P.I. crude oil	31.8° A.P.I. topped crude		27.9°A.P.I reduced crude
Cracking test No.	1	2	3	4
Yields, volume per cent of charging stock:				
Gasoline	82.0	63.1	54.9	59.8
Side-cut fraction	.....	.....	16.1	.....
Residuum	12.9	21.2	17.2	28.1
Liquid volume loss	5.1	15.7	11.8	12.1
Gas, cu. ft. per bbl. of charge	273	655	534	609
Overall yields, volume per cent of crude oil:				
Straightrun gasoline	.....	50.2	50.2	.....
Cracked gasoline	.....	31.1	27.1	17.3
Total gasoline	82.0	81.3	77.3	.....
Side-cut fraction	.....	.....	7.9	.....
Cracked residuum	12.9	10.5	8.5	8.1
Liquid volume loss	5.1	8.2	6.3	.....
Gas, cu. ft. per bbl. of crude oil	273	323	263	177
Properties of products:				
Untreated gasoline—				
Gravity, °A.P.I.	59.4	60.0	61.5	60.0
Mercaptan sulfur, per cent	0.045	0.028	0.028	0.030
Total sulfur, per cent	0.07	0.06	0.06	0.07
Vapor pressure, Reid, lb.	10.3	9.6	12.5	13.4
Octane No., motor method	64	68.5	69.5	70
100-cc. distillation:				
Initial, °F.	94	105	85	90
5 per cent	122	140	114	122
10 per cent	138	156	131	142
20 per cent	164	186	164	176
30 per cent	189	211	195	205
40 per cent	222	228	224	232
50 per cent	251	250	246	256
60 per cent	275	272	270	280
70 per cent	299	296	289	303
80 per cent	325	320	312	329
90 per cent	356	348	342	364
End point, °F.	395	404	391	404
Per cent over	98.5	97.5	96.0	95.5
Per cent bottoms	1.0	1.0	1.0	1.0
Per cent loss	0.5	1.5	3.0	3.5
Composition, liquid volume, per cent:				
Propylene	0.17	0.24	0.76	0.54
Propane	4.08	0.45	0.88	1.04
Isobutylene	0.97	0.95	1.24	1.22
n-Butylene	2.58	2.71	2.97	3.09
Butanes	4.80	2.92	3.82	3.66
Pentanes to 115° F.	8.60	11.78	11.28	10.26
Fraction boiling above 115° F.	82.40	80.95	79.05	80.19
Total	100.00	100.00	100.00	100.00
Fraction boiling above 115° F. gravity, °A.P.I.	53.1	53.7	54.1	53.1
Properties of side-cut oil:				
Gravity, °A.P.I.	.....	.....	29.4	.....
Specific gravity at 60° F.	.....	.....	.8794	.....
Sulfur, per cent	.....	.....	0.25	.....
Cetane number, C.F.R. motor	.....	.....	35	.....
Viscosity, Universal at 100° F., sec.	.....	.....	34	.....
Kinematic viscosity at 100° F., cts.	.....	.....	2.38	.....
Aniline point, °C.	.....	.....	41.0	.....
Aniline point, °F.	.....	.....	106	.....
Cloud point, °F.	.....	.....	—15	.....
Pour point, °F.	.....	.....	—20	.....
Cold test, °F.	.....	.....	—25	.....
100-cc. distillation:				
Initial, °F.	.....	.....	386	.....
5 per cent	.....	.....	424	.....
10 per cent	.....	.....	435	.....
20 per cent	.....	.....	451	.....
30 per cent	.....	.....	465	.....
40 per cent	.....	.....	475	.....
50 per cent	.....	.....	485	.....
60 per cent	.....	.....	496	.....
70 per cent	.....	.....	510	.....
80 per cent	.....	.....	530	.....
90 per cent	.....	.....	562	.....
95 per cent	.....	.....	597	.....
End point, °F.	.....	.....	628	.....
Per cent over	.....	.....	98.5	.....
Per cent bottoms	.....	.....	1.5	.....
Per cent at 400° F.	.....	.....	1.0	.....
Per cent at 572° F.	.....	.....	91.5	.....
Properties of residuum:				
Gravity, °A.P.I.	0.7	2.4	3.8	4.5
Viscosity furol at 122° F., sec.	269	231	260	195
B.s. and w., per cent	0.6	0.3	0.3	4.0
Sulfur, per cent	1.23	1.21	1.18	1.28
Cold test, °F.	45	45	45	45
Flash, Pensky-Martens, °F.	195	185	170	170
100-cc. distillation:				
Initial, °F.	480	480	467	450
Per cent at 572° F.	5.0	7.5	5.0	8.0

TABLE 10—PRODUCTION OF TRACTOR DISTILLATE

Yields, volume per cent of side-cut fraction:	
Tractor distillate fraction	91.2
Bottoms	8.8
Recovery	100.0
Overall yields, volume per cent of crude oil: (Cracking test No. 3)	
Straightrun gasoline	50.2
Cracked gasoline	27.2
Total gasoline	77.3
Tractor distillate fraction	7.2
Bottoms from side-cut oil	0.7
Cracked residuum	8.5
Liquid volume loss	6.3
Gas, cu. ft./bbl. of crude oil	263

Properties of fraction:	Tractor-distillate fraction	Bottoms from side-cut oil	15% straightrun gasoline, 85% 572° F. end-point tractor distillate
Gravity, °A.P.I.	30.2	20.6	33.6
Specific gravity at 60° F.	.8751	.9303	.8571
Sulfur, per cent	0.16	1.10	0.14
Oct. No., motor method	49	....	49.5
Viscosity Universal at 100° F., sec.	33.2	51.4	30.5
Kinematic viscosity at 100° F., cts.	2.16	7.82	1.59
Cloud point, °F.	....	....	—20
Pour point, °F.	....	....	<—30
100 cc. distillation.			
Initial, °F.	396	575	193
10 per cent	434	592	357
30 per cent	456	599	437
50 per cent	475	609	465
70 per cent	494	622	488
90 per cent	529	650	527
End point, °F.	572	690	569
Per cent over	99.0	99.0	99.0
Per cent bottoms	1.0	1.0	1.0
Per cent at 400° F.	....	....	16.0

TABLE 11—COMPOSITION OF CRACKING-PLANT GAS

Charging stock—	43.1° A.P.I. crude oil	27.9° A.P.I. reduced crude	31.8° A.P.I. topped crude
Cracking test number	1	4	2
Density (air = 1.00)	1.10	1.13	1.18
Composition, per cent by volume:			
Hydrogen	4.2	6.0	5.2
Nitrogen	2.5	0.3	9.0
Oxygen	0.0	0.0	0.0
Carbon monoxide	0.0	0.3	0.2
Methane	20.6	27.1	19.0
Ethylene	6.0	6.0	10.3
Ethane	21.0	18.6	25.1
Propylene	15.6	11.3	8.7
Propane	23.6	13.7	13.8
Isobutylene	0.5	1.7	2.7
n-Butylene	1.1	4.0	4.8
Butanes	3.0	6.3	6.0
Pentanes and heavier hydrocarbons	1.9	4.7	4.2
Total	100.0	100.0	100.0
Unsaturates, total	23.2	23.0	26.5
Propylene and butylenes	17.2	17.0	16.2
Pentanes and heavier hydrocarbons:			
As liquid, gal./1,000 cu. ft.	0.69	1.72	1.53
Per cent by volume of charge	0.4	2.5	2.4
Hydrogen sulfide by Tutwiler analysis:			
Grains/100 cu. ft.	440	....	....
Per cent by volume of gas	0.7	....	....

duce a 572° F. end-point tractor-distillate fraction. The yields and properties of the cracked distillate and bottoms, together with the properties of a blend consisting of 15 per cent of the 400° F. end-point straightrun gasoline from Turner Valley crude and 85 per cent of 572° end-point cracked distillate are shown in Table 10. The overall yield of 7.2 per cent cracked tractor distillate, based on the original crude oil, had an octane number of 49. The 0.7 per cent bottoms from the side-cut oil could be blended with the cracked residuum to lower its viscosity or returned to the cracking unit to increase the gasoline yield. The blend of 15 per cent straightrun gasoline and 85 per cent cracked tractor distillate has an octane number of 49.5 and is slightly lighter in gravity than the cracked distillate alone.

The gas produced in the cracking process is a valuable product in that the olefins it contains are raw material for the production of polymer gasoline and alkylate. The gases produced in cracking the Turner Valley crude oil, topped and reduced crudes were therefore analyzed by combined low-temperature fractionation and chemical absorption as shown in Table 11. The yield of pentanes and heavier hydrocarbons reported as liquid-volume per cent of the cracking-plant charge is the amount which would be recovered in an absorption system assuming complete recovery of these fractions. The difference in composition of the gas produced in cracking the topped and reduced crudes is attributed to a difference in the degree of stabilization rather than to a change in the cracking stock. From the analyses of the cracking-plant gases and gasolines it is estimated that by deep stabilization and processing each of these gases in a solid phosphoric acid catalytic polymerization unit the polymer gasoline yields would be 4.3 per cent, 6.3 per cent and 6.4 per cent based on the crude oil, topped crude, and reduced crude, respectively. Alternately, the butylenes from the cracking-plant gases may be reacted with the isobutane in an alkylation process to produce high-octane-number aviation gasoline. The predicted yields would be 5.0 per cent, 8.9 per cent, and 7.7 per cent of rerun alkylate based on the crude-oil, topped-crude, and reduced-crude cracking charge, while a general polymerization of the residual gas from alkylation would produce additional polymer, which when blended with the alkylate bottoms from rerunning, would yield an additional 2.4 per cent, 3.1 per cent, and 3.6 per cent gasoline based on the crude oil, topped crude, and reduced crude, respectively. Isobutane for alkylation and normal butane for blending the finished gasolines to vapor pressure would be required in addition

TABLE 12—LABORATORY TREATMENT OF CRACKED GASOLINE

Charging stock:	43.1° A.P.I. crude oil			31.8° A.P.I. topped crude			27.9° A.P.I. reduced crude		
Cracking test number:	1			3			4		
Treatment:	None	Caustic doctor sweet	Scrub copper sweet	None	Doctor sweet	Copper sweet	None	Doctor sweet	Copper sweet
Properties of gasoline:									
Gravity, °A.P.I.	59.2	58.8	58.7	59.5	59.3	59.5	59.5	59.3	59.6
100 cc. distillation:									
Initial, °F.	95	100	96	100	102	98	93	94	94
10 per cent	147	157	155	149	159	145	141	140	141
50 per cent	260	257	258	252	251	255	253	255	250
90 per cent	367	364	365	354	350	352	360	360	353
End point, °F.	400	399	399	404	405	405	405	405	406
Vapor pressure, Reid, lb.	9.8	9.2	8.9	9.0	8.4	8.9	12.0	11.7	11.9
Color, degrees Saybolt	19	21	17	2	3	2	6	5	4
Doctor test	Pos.	Neg.	Neg.	Pos.	Neg.	Neg.	Pos.	Neg.	Neg.
Peroxide number	0.59	....	....	1.40	....	....	0.35	....	....
Mercaptan sulfur, per cent	0.045	*0.015	*0.015	0.028	....	....	0.030	....	....
Total sulfur, per cent	0.07	0.06	0.06	0.06	....	....	0.07	....	....
Gum, copper dish, Mg./100 cc.:									
Without inhibitor	94	116	117	295	392	305	228	388	331
With U.O.P. No. 1, 0.025 per cent	...	6	7	...	...	...	...	...	...
With U.O.P. No. 1, 0.050 per cent	...	...	...	...	26	25	...	2	16
With U.O.P. No. 4, 0.005 per cent	...	6	5	...	...	...	...	...	...
With U.O.P. No. 4, 0.010 per cent	...	...	...	...	9	14	...	3	11
Oxygen bomb induction period, min.:									
Without inhibitor	75	60	75	55	45	55	70	50	65
With U.O.P. No. 1, 0.025 per cent	...	305	295	...	...	...	...	...	...
With U.O.P. No. 1, 0.050 per cent	...	...	...	...	200	170	...	230	180
With U.O.P. No. 4, 0.005 per cent	...	240	250	...	...	...	...	...	...
With U.O.P. No. 4, 0.010 per cent	...	...	...	...	170	220	...	170	230
Octane number, motor method:									
Without lead	64	63	63	68	67.5	67.5	69.5	68.5	69
With 1 cc. TEL/gal.	70	69.5	70	...	71.5	71.5	...	...	...
With 2 cc. TEL/gal.	73	73	73.5	...	75	75	...	...	...
With 3 cc. TEL/gal.	73.5	75.5	76	...	77.5	78	...	...	...

*After caustic scrub.

to that produced during the cracking operation.

Representative samples of the gasolines produced in the cracking tests were inspected for treatability as shown in Table 12. The combined straightrun and cracked gasoline obtained in processing the whole crude oil was given a preliminary caustic scrub and samples of the caustic-scrubbed material were sweetened with doctor solution and with copper-sweetening reagents. The mercaptan sulfur content of this gasoline was reduced from 0.045 per cent to 0.015 per cent by the preliminary caustic scrub and the sweetened gasolines show good response to the addition of inhibitor. With the addition of 3.0 cc. of tetraethyl lead per gallon the octane number of the copper-sweetened gasoline reached 76 by the motor method.

The cracked gasolines produced in processing the topped and reduced crudes were each sweetened with both doctor solution and copper-sweetening reagents directly and inspected for inhibitor susceptibility. The gasoline produced when cracking the reduced crude shows a loss of 0.5 points in octane rating after several days storage. This may be attributed to the loss of light hydrocarbons as indicated by a reduction in Reid vapor pressure from 13.4 to 12.0. The sweetened cracked gasoline produced from the topped crude requires 0.6 cc. of tetraethyl lead per gallon to reach 70 octane number.

A finished gasoline of 17°-21° Saybolt color, 0.06 per cent sulfur, low gum content and satisfactory storage stability may be obtained when a small quantity of inhibitor is added to the sweetened gasoline produced in the simultaneous topping and cracking operation on the Turner Valley crude oil. The sweetened inhibited gasoline produced in cracking the topped or reduced crude would probably require the addition of a dye to obtain a marketable product due to their poor color. Additional treatment such as a liquid or vapor-phase clay treat would be necessary to produce a water-white gasoline.

•

A.S.T.M. Specifications for High Temperature and Pressure

The American Society for Testing Materials has made available in convenient book form specifications on temperatures and pressures which may be applied to pipe installations. The designations apply especially well to installations for refineries.

Twelve of the 23 specifications published cover types of carbon and alloy-steel pipe and boiler tubes.

Castings of carbon and alloy steel for valves, flanges and fittings are covered in four of the specifications and forged or rolled alloy-steel pipe flanges in three other standards. Three of the specifications pertain to alloy-steel bolting materials and carbon and alloy-steel nuts.

Copies with ring binding are available at 260 South Broad Street, Philadelphia, Pa., for $1.25.

•

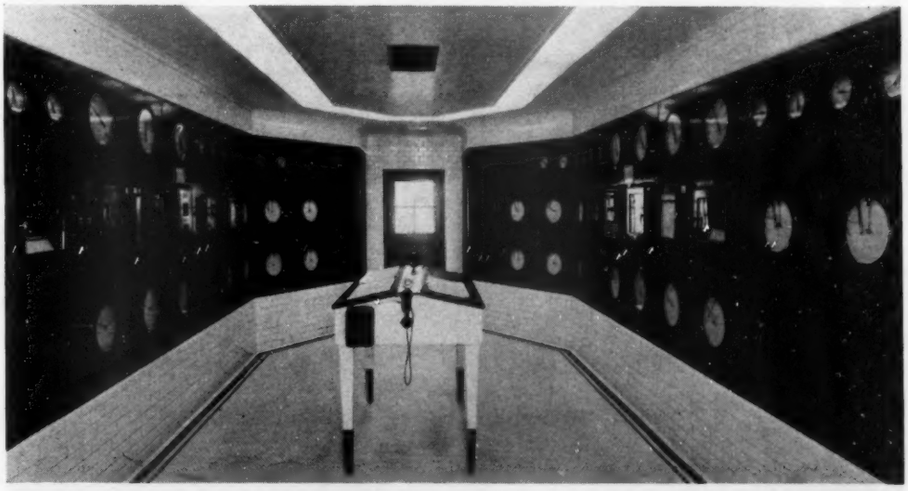
Lion Oil Controls Skimming, Cracking From One Room

THE automatic temperature, pressure and flow-controlling instruments, indicating thermometers and pressure gages which line the walls of Lion Oil Refining Co.'s new control room at the El Dorado, Ark., plant, have provided a centralized means for observing, recording and coordinating the operations of No. 4 combination topping and cracking unit and No. 2 cracking still.

Such centralization of control has proved to be of material assistance through increased economy, safety and convenience of operation.

Lion's new building houses 19 temperature recorders, 11 flow meters and controllers, 8 recording pressure gages, 2 recording pressure controllers, and other instruments which indicate temperatures at 88 different points in the units, in addition to complete automatic firing controls for the various furnaces.

The interior is indirectly lighted by recessed lamps concealed by frosted glass in the ceiling. Instrument panels are black-enameled steel. Walls and floors are tiled in black and white. The building is heated in winter and semiairconditioned in summer by a forced draft system. The exterior of the building is of buff brick with glass brick panels. It has concrete foundation, floors and roof.



Laboratory-Controlled Reflux Distillation Apparatus

By R. W. HARKNESS and R. E. BLAND
Houdry Laboratories, Catalytic Development Co., Marcus Hook, Pa.

A controlled reflux distillation apparatus is described which was built for routine use in the laboratory where the determination of yields on cracked products must be carried out on a large number of samples daily. The distillations are used both for control of pilot plants and for the prediction of commercial-plant yields from the pilot-plant operations. Data are presented showing the type fractionation obtained under standard conditions of operation, accuracy in duplicating results and comparison between plant and laboratory separation of products.

ONE important job which the petroleum-testing laboratory is called upon to do is the determination of gasoline yields from cracked or reformed distillates. Such samples may originate from commercial plants, or from pilot plants in the research and development laboratories. In many instances, a large number of samples must be handled, and the results must be obtained in a few hours to be of value, particularly where the results are used for control guidance. In addition to the yield determination it is usually desirable to have available enough of the products from the distillation so that routine inspections can be made, including octane and lead-susceptibility determinations on the gasoline fractions.

In order to carry out this work satisfactorily and promptly on a routine basis, some type of distillation apparatus is needed that is simple to operate, that will handle a charge upwards of 4 l. and that can be accurately controlled. Since it is advantageous to perform several distillations at the same time, automatic control is desirable to insure reproducible results and permit maximum efficiency of the operators' time. Further, it is desirable to have the equipment so constructed that the various parts can be interchanged or replaced in the case of breakage.

The controlled reflux distillation apparatus fulfills these requirements, and three such stills have been in continuous operation on a 24-hour basis for the past 6 months. During February three more were placed in operation. The accompanying photograph, Fig. 1, shows a typical installation.

Description of apparatus.—Fig. 2 shows a diagram of the apparatus. It is constructed entirely of glass except for the reflux condenser *H*. This condenser is made from coiled copper tubing inside an insulated metal bath. The different parts of the apparatus are connected by interchangeable spherical joints lubricated by a mixture of bentonite and glycerin. The still pot *A* is a short-neck, round glass flask, and two sizes are normally used of 3 and 5 l. capacities. A thermometer well for liquid temperature measurements is sealed into the side of the flask and extends to within ¼ in. of the bottom. The flask may be heated in any convenient manner, preferably with an electrical unit whereby it is possible to obtain an even application of heat. The Glas-Col heating mantle shown in the photograph is convenient and gives a very even distribution of heat. It is made from glass fabric with heating coils embedded. This gives a unit of low heat capacity which is an aid in distillation work where rapid response to adjustment may be required to prevent flooding. The two halves of

Fig. 1—Typical installation of the controlled reflux column

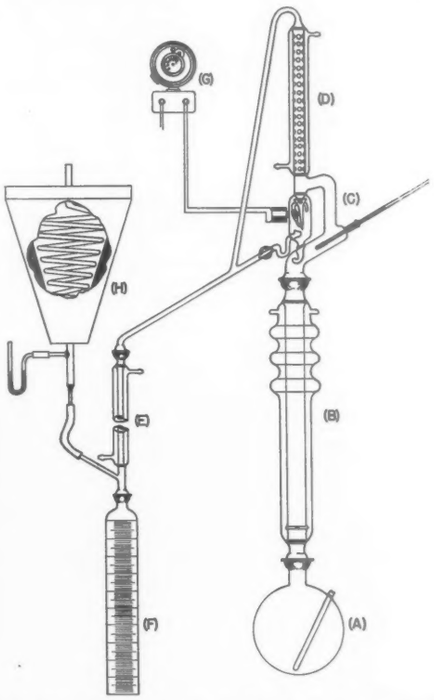
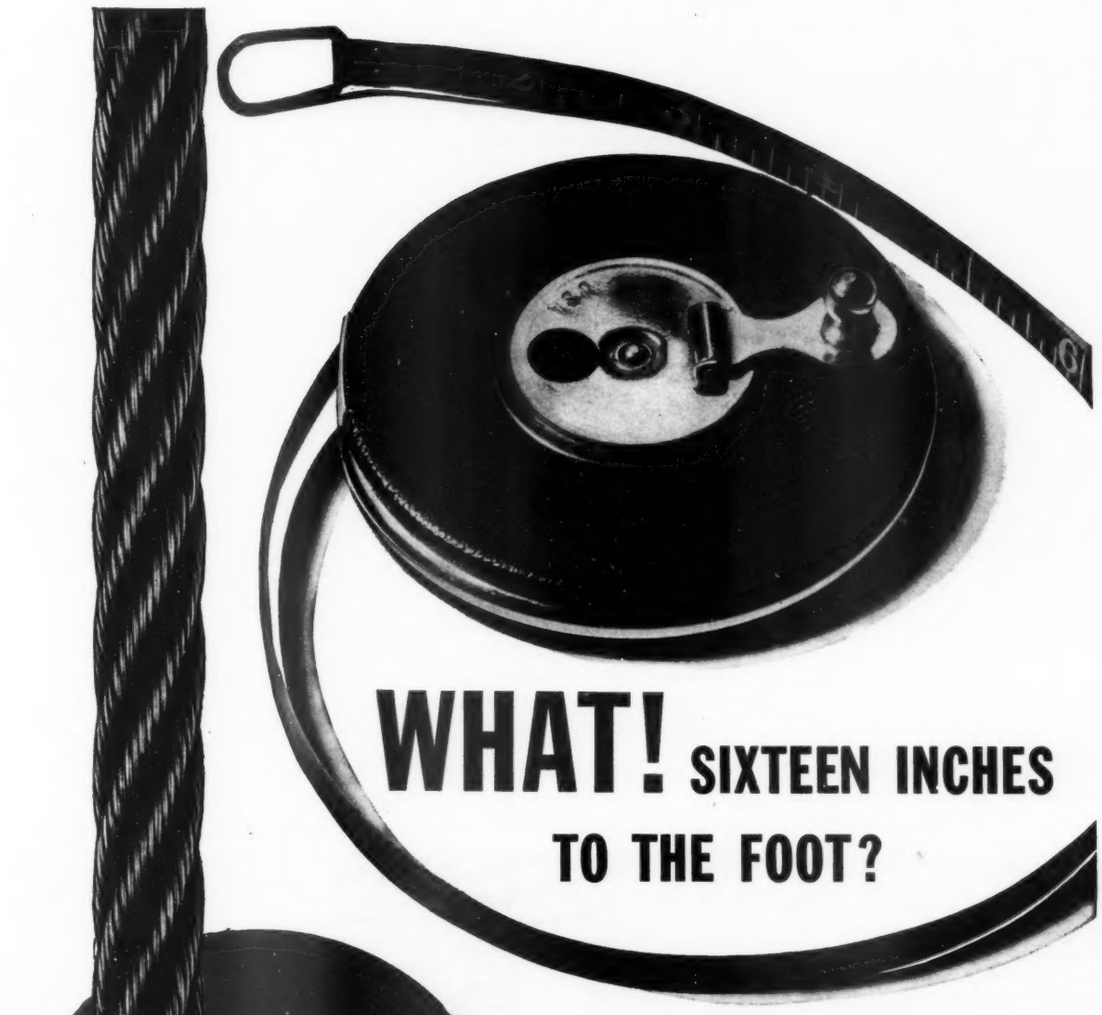


Fig. 2 — Arrangement of controlled reflux-distillation equipment



WHAT! SIXTEEN INCHES TO THE FOOT?

WICKWIRE ROPE

You'd say it was the greatest buy in the wire rope market.

When you measure the service that every twelve inches of Wickwire Rope gives the user in comparison with accepted standards, you find Wickwire offers sixteen, eighteen, yes and twenty-four inches and more in value for every twelve inches of rope you pay for.

Why?... Wickwire Spencer has never been satisfied that standard specifications are the goal of quality. Better metallurgy, more careful manufacture, honest recommendations as to construction to suit the use and valuable information as to care of rope have all contributed in giving Wickwire Rope longer life. Specify Wickwire Rope the next time you order.

WICKWIRE SPENCER STEEL COMPANY

General Offices: 500 Fifth Avenue, New York City. Sales Offices and Warehouses: Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles, Tulsa, Chattanooga, Houston, Abilene, Texas, Seattle. Export Sales Department: New York City.

the heater are fitted around the flask and joined with a zipper. This type heater is satisfactory provided a liquid temperature in excess of about 550° F. is not required when running at the relatively high rate used in this work. The electrical heat input is controlled by Variacs.

The flask and heater are supported by a cradle under spring tension which holds together the glass joint connecting the flask and column.

The fractionating column *B* is 1½ in. i.d. and 18 in. long inside the vacuum jacket. The jacket around the column is silvered inside, preferably without an observation strip although one is shown in the photograph. It is essential that the jacket be thoroughly evacuated to cut down on heat loss. The vacuum jacket is used in place of a heating circuit, thus simplifying the control. The bellows section in the outer wall is provided to eliminate the possibility of breakage due to unequal expansion.

The tower packing is 16¼ in. in depth and consists of ⅛-in. stainless-steel helices of 0.016-in. diameter wire supported by a stainless steel screen at the bottom of the column.

The cleverly designed reflux regulator *C* was purchased from the Ace Glass Co., and gives an automatic control of the reflux ratio when used with the electric timer *G*. It consists of a hanging glass funnel balanced so that condensate draining from condenser *D* will reflux back into the column through the small liquid hook seal. The funnel has attached to its side a metal strip so that it may be moved by an electromagnet from the outside. The electromagnet is activated by an electric timing device *G* which may be adjusted for cycles that will give different reflux ratios. In operation the vapors from the column pass over the thermometer and through the by-pass around the reflux section into the condenser *D* where condensation occurs. The liquid drains back into the small funnel which is either delivering back into the column or out into the receiver. For the 5:1 reflux ratio which is normally used the funnel delivers product to the receiver *F* for 3.3 seconds and back into the column for 16.7 seconds, thereby operating on a 20-second cycle. Tests have shown that shortening the cycle does not cause a noticeable improvement in fractionation. Connections are made so that one timer controls the reflux sections on three stills. These adjustable electric timers may be purchased from some of the well-known electric supply houses.

Condensers *D* and *E* are of the West type. The top condenser was originally put at an angle as shown in the photograph because of limited headroom, but the vertical form as shown in Fig. 2 is preferred provided the overhead clearance is sufficient. Tap water is circulated through condenser *D* and a solution of refrigerated ethylene glycol and water at about 0° F. is circulated through condenser *E* in order that the light ends from the charge will be condensed; also, if this condenser is not held quite low, trouble will result from plugging in the reflux condenser by solidified gas hydrates. With condenser *E* at 30°-40° F. these gas hydrates did frequently plug the reflux condenser. Reflux condenser *H* is maintained at —60° F. with dry ice and spirits to further safeguard against loss of light ends.

The calibrated receiving cylinder *F* is built without the conventional base so that it may be placed in contact with the inner wall of the glass cooling bath which surrounds the cylinder during operation. The bath is likewise maintained at about 0° F. and consequently frost forms on the outside. If glycerin is rubbed on the frosted surface opposite the point of contact with the receiving cylinder no difficulty is experienced in reading the volume of product.

Operation.—With this type apparatus it has been found practicable for two operators to keep three stills running at once. The stills are operated at a 5:1 reflux ratio and a takeoff rate of 10 ml. a minute. Since the reflux is automatic, the chief duties of the operator consist of maintaining the rate constant by adjustment of the heat input, maintaining the cooling-medium temperatures constant and recording data showing liquid and vapor temperatures and actual distillation rate.

The actual time required to carry out one complete distillation on a 4-l. charge will average about 4 hours assuming a motor gasoline is separated with a yield of 50 per cent volume based on the charge. This includes approximately 20 minutes for charging the sample and starting the distillation, and 20 minutes after the distillation for removing the charge flask and receiver. The still is then ready for another charge which can be started immediately using another flask. About 45 minutes must be allowed for the bottoms from the previous run to cool before measuring. It has been possible for two men a shift to complete fifteen 4-l. distillations in 24 hours on three stills. Where tests are not required on the products, 1-l. charges are sufficient for yield determinations. Three-liter flasks are used for charges up to 2 l., and 5-l. flasks on charges in excess of 2 l. In order to assure consistent yield results, the usual precautions must be exercised when measuring volumes and correcting for temperature and allowing for drainage losses.

Typical results.—It should be stated that the purpose in setting up the column was not to obtain a high degree of fractionation, but rather to obtain fractionation that would approximately duplicate reasonably good commercial separation. This fact, combined with the desire for speed in carrying out the distillation led to the selection of the particular column in use. The high rate of low reflux used in operation makes the actual separation considerably less than could be obtained under conditions of maximum efficiency. At the condition of 5:1 reflux ratio and rate of 10 ml. a minute the tower operates safely under the flood point.

It is estimated from a run on carbon tetrachloride and benzene that the column has the equivalent of 3½-4 theoretical plates at the boiling rate used, (5:1 reflux ratio and 10 ml. a minute collected); however, it was not run at total reflux therefore the figure is only an approximation. In cases where a high degree of fractionation is required, a longer column can easily be installed in place of the short one. It is only necessary to raise reflux section and lengthen the product lines. The use of the interchangeable spherical joints facilitates changes of this nature.

To date, the apparatus has only been used for the distillation of cracked products from pilot-plant runs for the determination of aviation and motor-gasoline yields. Yields so obtained are used to predict commercial results from the pilot-plant operation.

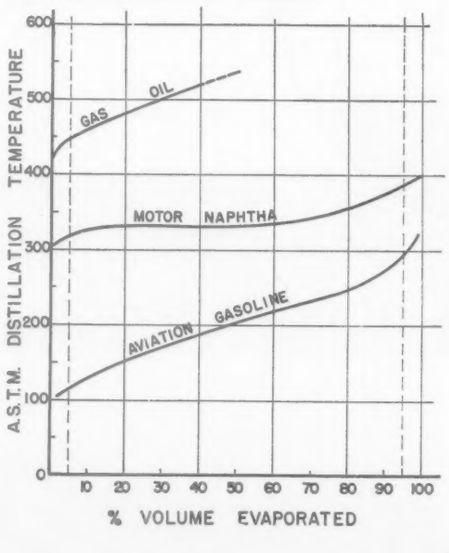
Since motor and aviation gasolines must be separated to conform to boiling range specifications as determined by A.S.T.M. distillations, these distillations are used for control on the tower operation. Those familiar with A.S.T.M. distillation results are aware that the amount of overlap or spread between the 95 per cent evaporated point of the overhead and 5 per cent of the following cut gives a fair idea of the degree of fractionation. Similarly the end point and initial boiling may be used, but they are not usually as reliable due to difficulty of duplication. Figs. 3 and 4 show a comparison between A.S.T.M. distillations on products separated by commercial plant and laboratory results on a similar charge. A.S.T.M. distillations on the products are plotted with abscissas showing the per cent evaporated and ordinates the corresponding temperatures. The products consisted of aviation gasoline, motor naphtha and bottoms. The A.S.T.M. distillation of motor-gasoline cut shown in Fig. 4 represents a blend of motor naphtha and aviation gasoline in yield proportions.

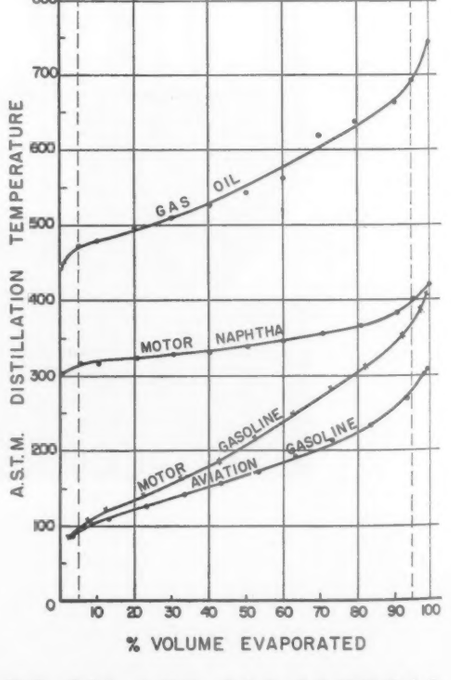
These results show that the degree of separation obtained with the laboratory distillation is about the same as that in the plant. Comparing the 95 and 5 per cent evaporated points on the consecutive cuts, it is seen that a spread of 45° F. is shown between the aviation and motor naphthas in the laboratory against a 25° spread in the plant, and 74° F. spread between motor naphtha and gas oil in the laboratory against 62° F. in the plant. This would indicate a slightly better separation in the laboratory between aviation and motor naphtha than in the plant, and about the same in both laboratory and plant between

(Continued on Page 196)

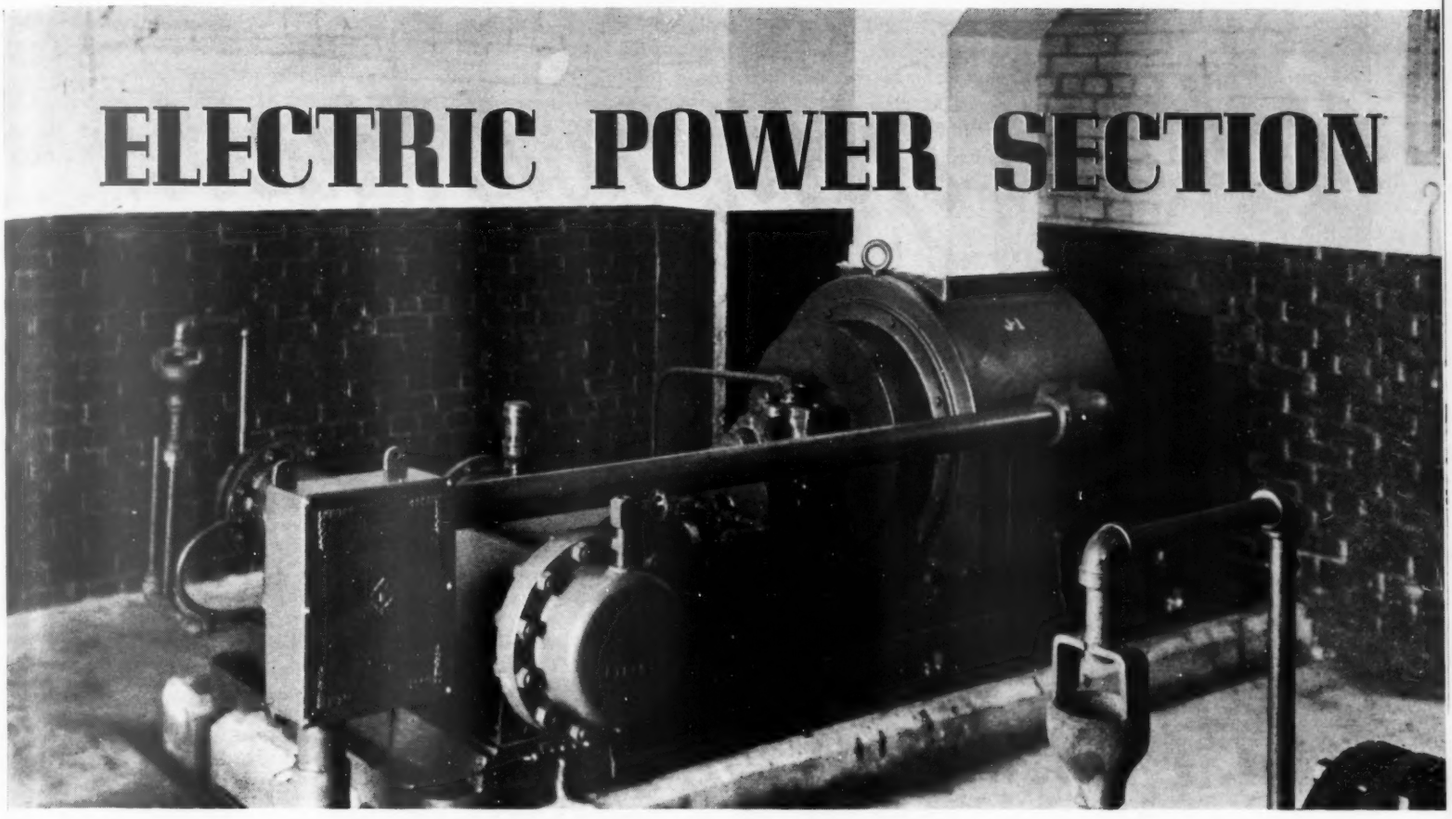
Fig. 3 (below)—A.S.T.M. distillation on products from a commercial plant

Fig. 4 (right)—A.S.T.M. distillations on products from laboratory-controlled reflux distillation





ELECTRIC POWER SECTION



Explosionproof, duct-ventilated 500-hp. induction motor driving centrifugal hot-oil pump

Refiners Show Increasing Use of Electric Power

By W. H. STUEVE
Engineer, Oklahoma Gas & Electric Co.

IN the early days of oil refining the principal source of mechanical energy, to perform the various pumping functions, was from steam, which was exhausted either against back pressure for distillation purposes or recovered in the main steam-exhaust header, or some of it entirely lost to atmosphere. The conventional straight-line, single or duplex double-acting plunger pump was used almost entirely, and the centrifugal pump was almost unknown. Gradually the centrifugal pump came into use and with it came the steam turbine and electric motor. Originally the skimming refinery required about 6 bbl. of condensing water to be pumped for every barrel of oil charged and about 2 hp.-hr. of mechanical energy were required to refine a barrel of oil, of which an average of only 21 per cent was obtained from the outside power sources of the electric utility. With the advent of various cracking processes, the total mechanical energy required was doubled, the condensing water required was quadrupled, and an average of about 38 per cent was obtained from the power utilities.

A recent study shows that the average complete refinery requires four to five times the mechanical energy originally required by the skimming plant and an average of about 44 per cent of the total mechanical energy required is supplied by outside utility sources.

The above-mentioned increases in use of utility power for oil refining are averages obtained from a study of 44 refineries located in the Mid-Continent area, and the estimates should not be construed as meaning that each complete refinery will actually purchase 44 per cent of the total needed mechanical energy. The study further reveals that in some individual refineries the utility purchases may amount to as much as 90 per cent of their total requirements, and it may be as low as 10 per cent of their total requirements, depending on the amount of steam generated and its use thereafter. There are today about 400 refineries in operation in the United States, and while the study covered only slightly more than one-tenth of the number in operation, through which only one-eighth of the total crude oil refined was charged, yet, some conclusions can be drawn that would tend to indicate the trends toward increased use of electric power as the refining process requires more and more energy.

TABLE 1—PERCENTAGES OF PURCHASED UTILITY POWER AND GENERATED ELECTRIC POWER

Type of refinery—	Average utility power required	Average electric power generated with internal-combustion engines	Average electric power generated with steam power	Total electric power required
Skimming (17)	21%	17%	0%	38%
Cracking (17)	38	6	0	44
Complete (10)	44	5	17	66

Write your own figure...

Saved on Installations _____ %
Production Increased _____ %
Salvage Value Greater by _____ %

and you'll be CONVINCED that K.G.& E. POWER provides... maximum efficiency at low cost

Yes Sir! A figure that shows how you can save money and increase profits is always pleasing. That's why K.G.&E. power performance figures will please you with a story of maximum efficiency at the lowest possible cost. Ask for a FREE consultation on your power problems. Whether it is drilling, pumping, or refinery work, K.G.&E. SERVICE will do it best.

★ Low installation cost.
★ Greater efficiency.
★ Greater safety.
★ Greater salvage value.
★ Greater flexibility.
★ Automatic operation.
★ Always ready to go— regardless of weather.

KANSAS GAS AND ELECTRIC COMPANY

Electricity is Cheap

Offices at Wichita . Newton . El Dorado . Arkansas City . Pittsburg . Independence

Table 1 illustrates the amount of utility electric power purchased and the amount generated with steam or internal-combustion engines as compared to the total mechanical and/or electric energy required to refine oil by the three general types of refineries.

It can be noted that as the refining process becomes more complex, consequently requiring more energy, utility power shows an increase as compared to the total, whereas, the generation of electric power by internal-combustion engines shows a decided decrease in passing from the simple skimming plant to the complete refinery. Other records obtainable from the U. S. Bureau of Mines can be used to illustrate the trend toward greater use of utility electric power in the refining process, when viewed from the operating records of the total refining industry in this country.

It can be noted from Table 2, during the 10 years studied, that as unit fuel requirements decreased 17 per cent, electric requirements increased almost 43 per cent. It is generally understood that in recent years refining processes have required higher temperatures and pressures, necessitating the use of more fuel per unit processed, leading to the conclusion that the increased use of unit utility electric power, no doubt, can be attributed in a large measure to the replacement of steam-mechanical drives with electric-motor drives.

TABLE 2—HEAT VALUE OF FUELS AND UTILITY ELECTRIC ENERGY REQUIRED TO REFINE OIL FROM 1930 TO 1939 (U. S. Bureau of Mines)

Year—	Barrels of crude oil refined	Utility electric energy purchased kw. hrs.	Fuel in therms (100,000 B.t.u.) per bbl. refined	Purchased utility kw. hrs. per bbl. refined
1930	927,447,000	826,640,000	6.72	.890
1931*	.....	.....	...	....
1932*	.....	.....	...	....
1933	861,254,000	900,468,000	6.60	1.043
1934	895,636,000	1,022,984,000	6.38	1.144
1935	966,243,000	1,071,841,000	6.15	1.112
1936	1,068,570,000	1,191,023,000	5.97	1.118
1937	1,183,440,000	1,310,589,000	5.62	1.110
1938	1,165,015,000	1,400,499,000	5.67	1.220
1939	1,237,840,000	1,565,254,000	5.57	1.270

*No records available for 1931 and 1932.

The oil-refining industry consumes about 2.5 per cent of the electric production of the utilities in the United States, which is sold to manufacturers, and represents the installation of about 1.6 per cent of the total horsepower in electric motors used in this country by all industries or manufacturers. It is estimated that oil refineries have installed well over 450,000 hp. of electric motors using utility electric power and 150,000 hp. using their own generated power. Years ago, or immediately after the expansion of utility high-line systems throughout the states, the refiner was somewhat reluctant to accept outside sources of power for the operation of his equipment, feeling greater security in having control of such energy source within the confines of his own plant. The utilities met this challenge by providing dual power lines, automatic switches, and other refinements in service facilities, until today this objection has been largely overcome.

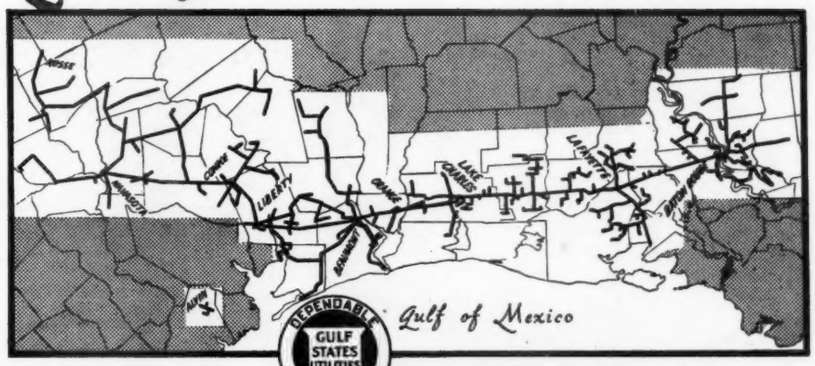
Another apparent obstacle to the use of electric power was the belief on the part of the refiner that speed control was essential and obtainable only with steam-driven equipment. This problem of the necessity of speed control has been overcome to a large extent as evidenced by the sales of prime movers used to actuate the larger pumps. A survey conducted about 1 year ago among the crude-charging-pump manufacturers who sold 90 per cent of the hot-oil pumps sold during the previous 4 years, revealed that 42 per cent of the total horsepower (84,250) sold consisted of constant-speed induction-motor drive. Another interesting fact revealed by this survey of prime-mover sales for hot-oil pumps was that only 10 per cent of the total horsepower was installed with dual drive (steam turbine and electric motor), whereas, less than 2 per cent were to be driven with gas engines through speed-increasing gears. The remainder of the pumps (46 per cent) were sold for direct drive with steam turbines operating either condensing or noncondensing.

The hot-oil pump was selected for this

(Continued on Page 158)

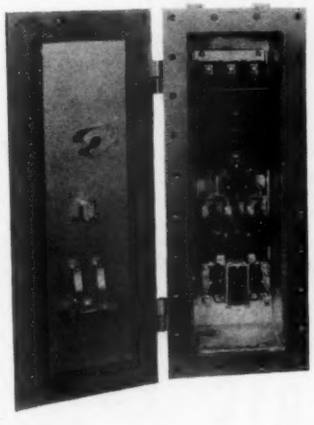
READY WITH RESERVE

Prepared to Serve!



DEPENDABLE GULF STATES UTILITIES CO. PUBLIC SERVICE

General Offices:—Beaumont, Tex., and Baton Rouge and Lake Charles, La.



• Circuit Breaker, Control Station, Overload Relay Reset and Magnetic Motor Starter all mounted on a steel pan, securely held in place by four bolts, but easily removable if desired when pulling in the wires.

NEMCO A-C COMBINATION STARTERS

EXPLOSION RESISTING

Built of Boiler Plate

- Hinged door cover secured by corrosion resisting high tensile cap screws.
- Doors easily removed by lifting off hinged pins.
- Control Station mounted on Starter Pan eliminating flexible leads to enclosure door.
- Enclosure can be mounted flush and in this position door will open approximately 90 degrees.
- Conduit Hubs can be welded in any location desired.
- Circuit Breaker, Overload Relay Reset and Control Station externally operated. All operating shafts of stainless steel.

Line voltage type starters and thermal trip air circuit breakers, designed for Class 1, Group D, Hazardous Locations (Gasoline, petroleum vapors, natural gas, etc.) Motor Starter applies line voltage to the motor and Air Circuit Breaker acts as a disconnect switch, providing short circuit protection.

All units enclosed in HEAVY TYPE BOILER PLATE CASE, WELDED, affording maximum factor of safety.

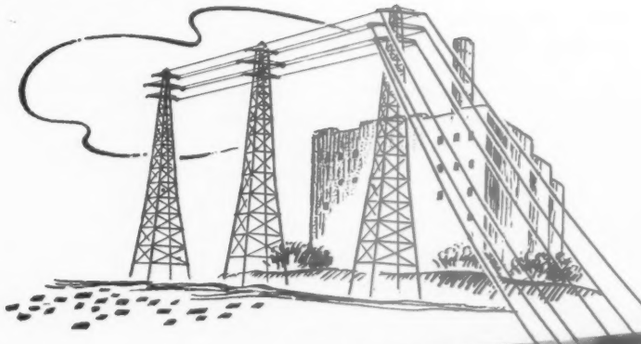
* This control is designed to conform with the standards of the Underwriters' Laboratories, Inc., but has not been tested or listed by them.

Complete specifications and prices furnished on request.

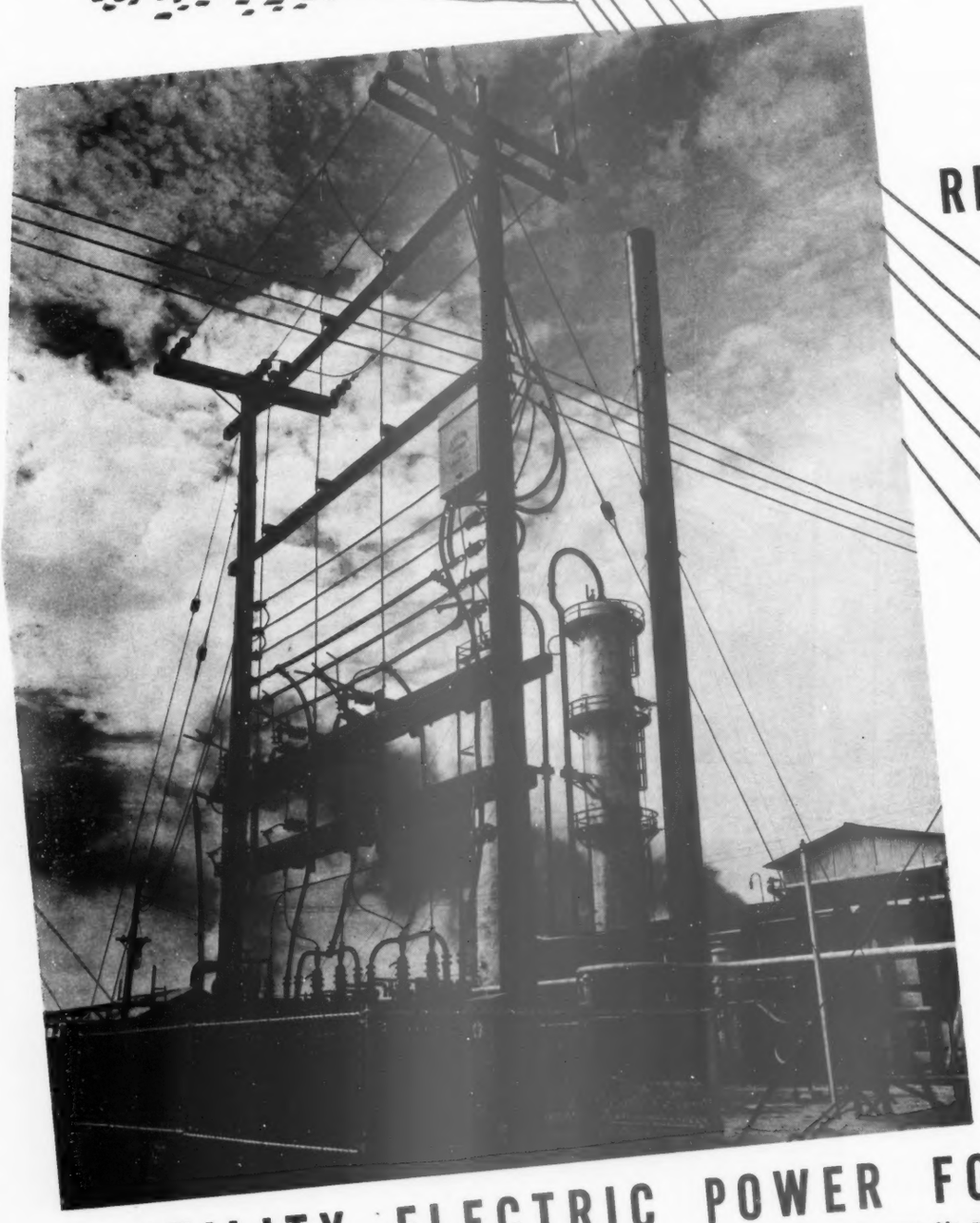
ELECTRICAL SPECIALTIES FOR THE PETROLEUM INDUSTRY

NELSON ELECTRIC MANUFACTURING COMPANY

217 NORTH DETROIT TULSA, OKLAHOMA TELEPHONE 5-1241



REFINERS TO *Utility*



REFINERS FIND

PROFIT! BY USING Utility ELECTRIC POWER

UTILITY ELECTRIC POWER FOR DEFENSE

Uncle Sam needs the indispensable assistance of the Refining Industry, more and more. The Refining Industry in turn needs efficient, available and economical power. The Utility Electric Power industry stands ready, able, willing and experienced to meet any emergency or any daily need that the refiner may require.

POWER FOR REFINING...DRILLING...PRODUCTION...AND PIPE LINES

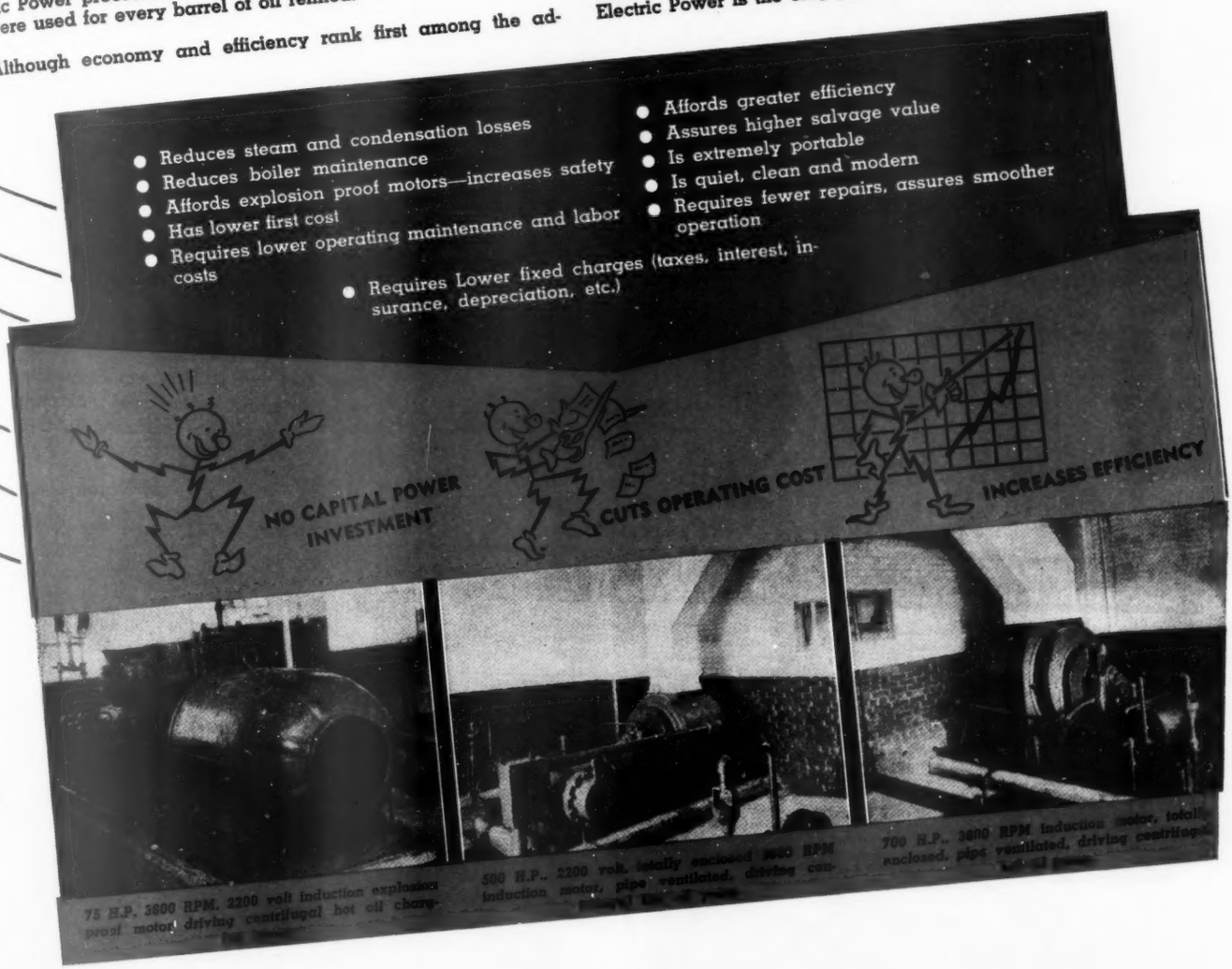
Swing MORE AND MORE *Electric Power!*

ELECTRIC POWER INCREASES EFFICIENCY, CUTS COST

● The consumption of Utility Electric Power for refining purposes has INCREASED 43% in the last ten years, indicating a definite and substantial swing to electricity as a source of power in this important phase of the petroleum industry. To be exact, 1,565,000,000 KWH was consumed for refining in 1939, as compared to 826,640,000 KWH in 1930. In 1939 Utility Electric Power processed 1,237,000,000 barrels of oil, or 1.27 KWH were used for every barrel of oil refined.

Although economy and efficiency rank first among the advantages of Utility Electric Power, the extra safety factor of explosion proof motors is of no less importance when considering its many merits. And the fact that this modern power is available at all times, under all conditions, in any amount needed is worthwhile considering, too. If you look at it purely from an economy standpoint, don't overlook the fact that there is no capital power investment when you use Utility Electric Power. It's on a "pay-as-you-go" basis. Check and double-check it from all angles and you'll be convinced that Utility Electric Power is the only power for your requirements.

- Reduces steam and condensation losses
- Reduces boiler maintenance
- Affords explosion proof motors—increases safety
- Has lower first cost
- Requires lower operating maintenance and labor costs
- Affords greater efficiency
- Assures higher salvage value
- Is extremely portable
- Is quiet, clean and modern
- Requires fewer repairs, assures smoother operation
- Requires Lower fixed charges (taxes, interest, insurance, depreciation, etc.)


NO CAPITAL POWER INVESTMENT
CUTS OPERATING COST
INCREASES EFFICIENCY
75 H.P. 3600 RPM. 2200 volt induction explosion proof motor driving centrifugal hot oil charg-
500 H.P., 2200 volt, totally enclosed 3600 RPM induction motor, pipe ventilated, driving cen-
700 H.P., 3600 RPM induction motor, totally enclosed, pipe ventilated, driving centrifugal

Use Utility Electric Power!

PETROLEUM ELECTRIC POWER ASSOCIATION

Box 1498, Oklahoma City, Oklahoma

study because it requires a large power unit to operate it and this service is considered perhaps the most essential in most refineries. It requires absolute continuity of power supply. These units range in size from 200 hp. to 1,750 hp. depending on the capacity of crude throughput. Conclusions reached from this survey of sales of large hot-oil charging pumps indicated sales of 44,800 hp. of attached electric constant-speed induction motors, which certainly must be construed as meaning that the refiner is satisfied with the class of continuous-power service given by the power utilities and that he has also accepted the constant-speed motor.

The electric manufacturers have contributed a great deal to the acceptance of electric motors for the critical duty required of the crude-charging pumps, not only from the standpoint of relays and switches, which enable the power utilities to provide continuous service, but also in the design of the motor itself.

One type of induction motor offered for this duty is the explosionproof or totally enclosed type; another is the ventilated type, wherein the outside air is supplied to the housing of the motor through ducts and after performing its cooling function the air is returned to outside atmosphere again through ducts, thus eliminating any chance of gaseous mixtures being in contact with the motor coils or magnetized iron.

Still another type, which entirely overcomes the hazard of fire or explosion, is the inert-gas-filled motor, wherein noninflammable carbon dioxide is supplied to the spaces in the housing and a low pressure is maintained of about 1 lb. per sq. in. The motor housing is connected through suitable reducing valves to an outside tank of carbon dioxide or other inert gas. The first 1,000-hp. installations of this type were made for the Richfield refinery in California.

It has been shown previously from the survey of the U. S. Bureau of Mines that in recent years oil refineries are required to use an average of 560,000 B.t.u. of fuel for each barrel of oil refined, such fuel being either burned under boilers to produce steam or under stills to produce heat. The average fuel consumption of these refineries indicates they produce 47.5 per cent of nonmarketable fuels in the form of acid sludge (4 per cent), still gases (43 per cent), and petroleum coke (0.5 per cent), and the remainder of their heat supply is obtained from marketable fuels in the form of oil (32 per cent), coal (5.5 per cent), natural gas (14 per cent), and purchased steam (1 per cent).

Thus, if the relative sale price of the marketable fuels is high as compared to equivalent cost of utility electric energy, it might prove of economic merit to the refiner to sell his oil, and not buy the coal or natural gas, and in turn purchase certain portions of his mechanical-electric energy requirements. On the other hand, if the sale price of the marketable oil is relatively low, it is easy to understand why refiners would attempt to produce all of their energy requirements in their own plants, since 80 per cent of the fuels then are either nonmarketable or of such low market value as to make it imperative that it all be consumed in their own plant.

Future Fuel Value

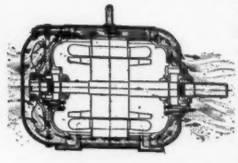
The problem confronting the refiner, with respect to deciding the best economic manner in which to secure his power supply, requires that such refiner must be able to predict the market value of about 52.5 per cent of all his fuel requirements for 5 or 10 years into the future, because the value of fuel oil, and to some extent natural gas, is based on and follows closely the posted price of crude oil. On the other hand, the power utility is usually protected in fuel requirements for long periods of time in the future. If the utilities find that oil is too expensive, then cheaper slack coal or sometimes natural gas can be used since they are easily interchangeable under the utility boilers.

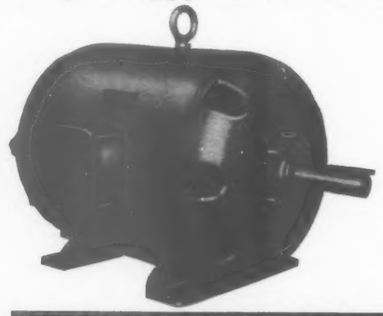
Again, the refiner is faced with rapidly changing processes, requiring more or less power than previously required, so that power-plant investment may be too great, based on the new requirements, or the power-generation capacity may be too small, as the case may be. Most industries of the oil-refining class consequently will not make investments in new processes or new power-generation plants unless the return of the

Rain, snow, heat, dust, dirt, and explosive fumes cannot harm Wagner CP or HP motors because extra protection is incorporated in their construction. They are built to "take it"! And today, because of their dependable, trouble-free performance under the most severe operating conditions, Wagner CP and HP motors are the choice of the petroleum industry. They are built in seven electrical types to take care of the various types of equipment used in refineries, along pipe lines or in the oil fields.

WAGNER TYPE CP MOTORS
FOR OUTDOOR INSTALLATIONS

The use of Wagner CP totally-enclosed fan-cooled motors in the oil fields and refineries practically eliminates shutdowns for motor maintenance and repair, because CP motors are fully protected against dust, fumes, moisture and corrosive gases—agents which play havoc with open type motors. These destructive elements, prevalent in outdoor and refinery installations, cannot reach the vital parts of the CP motor because of its double frame construction. An outer frame guides a strong cooling draft of air over the motor; the inner frame is tightly sealed to prevent contact of destructive elements with the bearings or windings. Thus, costly shutdowns for motor maintenance are eliminated.





WAGNER TYPE HP MOTORS
FOR EXPLOSIVE ATMOSPHERES

Wagner HP motors are tested and approved by Underwriters' Laboratories for Class 1 Group D hazardous locations where gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvent vapors, natural gas and other flammable liquids are manufactured, used, handled or stored in other than their original containers. Hence, they are ideally suited for the petroleum industry. However, meeting Underwriters' standards is not the only factor considered in the building of Wagner Explosion-Proof motors. Wagner HP motors are designed and built to give many years of trouble-free service under the most severe operating conditions to which explosion-proof motors are likely to be subjected.

Underwriters Laboratories Inc.
INSPECTED
ELECTRIC MOTOR FOR HAZARDOUS LOCATION
CLASS 1 ELEC 6646
GROUP D NO. L [illegible]

Send for Bulletin MU-182 which illustrates and describes Wagner CP and HP motors as well as other types of Wagner polyphase motors.

M41-18

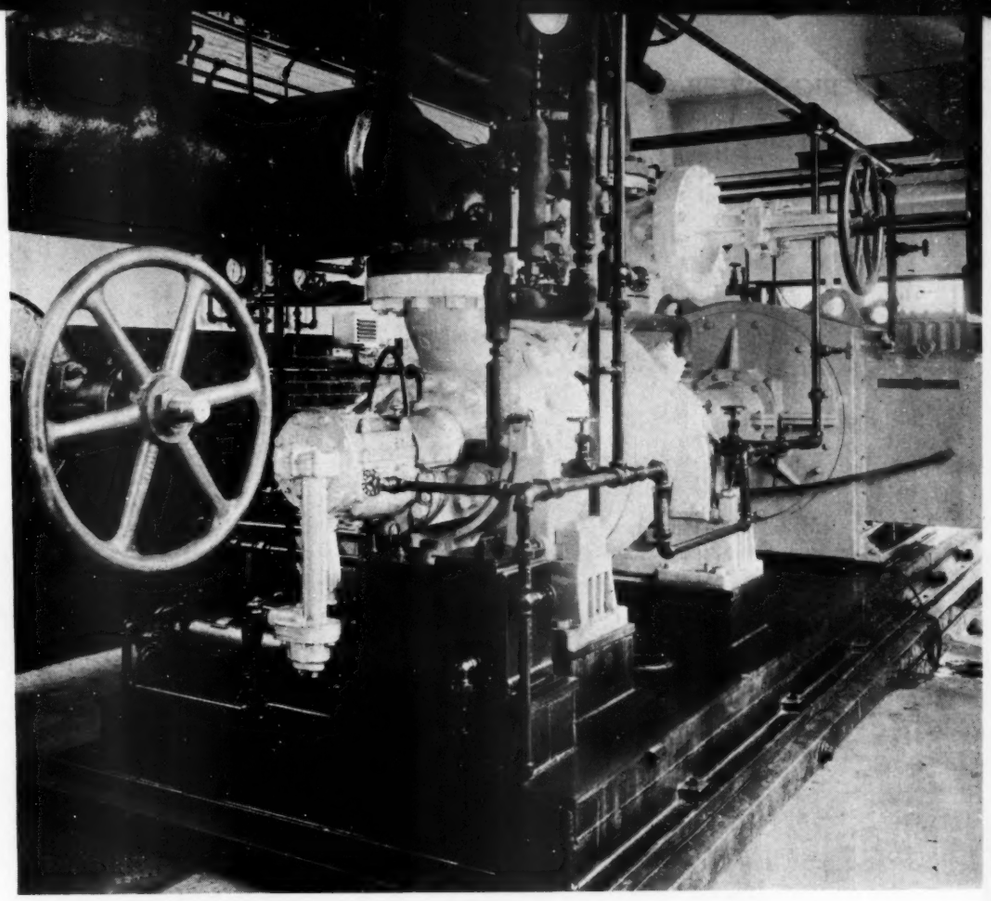
Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.
MOTORS • TRANSFORMERS • FANS • BRAKES

original new capital required can be foreseen in a very small number of years. On the other hand, the power utility, making the same energy product year after year, is not faced with this necessity of obtaining a quick return of its capital and consequently does not fear obsolescence to the same degree as the refiner.

Buy All Utilities

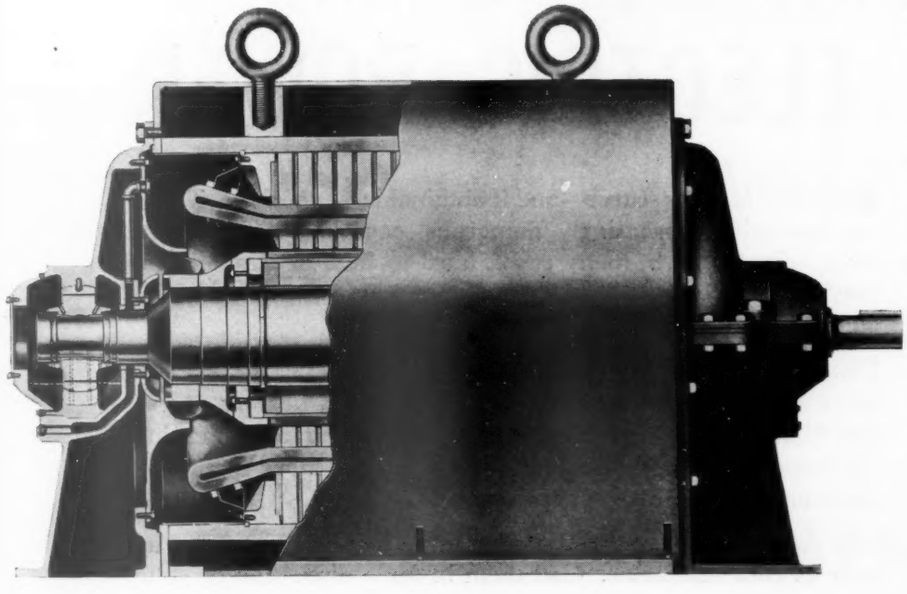
To illustrate this economic trend of thinking, several large refineries on the Gulf Coast and one on the West Coast actually purchase all their steam and electric requirements from power utilities, under conditions of contract in which the utility makes the entire power-plant investment, buys all the nonmarketable fuels the refineries produce, and in turn delivers the refiners steam and a certain proportion of electric power generated. This sort of arrangement, of course, will not be economically feasible everywhere, but it does have merit if the geographic location of the generating plant and refinery can be fitted into the utility's load or transmission center.

The generating plants, in the cases mentioned, have installed steam turbines which can operate full condensing, full back-pressure, or extraction type to compensate for the wide fluctuations in the refiner's steam load. Since the utility's transmission system can absorb almost any amount of electric energy produced, the disposal of electric power is not much of a problem where the refiner's electric load fluctuates. Steam requirements may vary from normal conditions to double the rate, and electric-power requirements may vary from normal to 1½ times the average normal rate.



Surface-cooled, inert-gas-filled 1,000-hp. motor located in a Watson, Calif., refinery

More attention is being given to studies to determine the most economical prime movers to use for specific power loads in refineries. New processes are constantly being installed to raise the octane rating of the gasoline or to improve the quality of the lubricating-oil output. In the former case, the cracking units require pumping of the charge under conditions of high pressure and high temperature, which requires motor or steam turbines or gas engines of relatively large horsepower. The pump manufacturer, in recent years, has developed the high-speed centrifugal pump, through the aid of the metallurgists, having high efficiencies, to such a point that the plunger pump is rarely considered for the hot-oil-charging service. This centrifugal pump is direct connected to the 3,000 or 3,600-r.p.m. motor or steam turbine, and can be driven also by a slow-speed gas engine through speed-increasing gears at the same high speed.



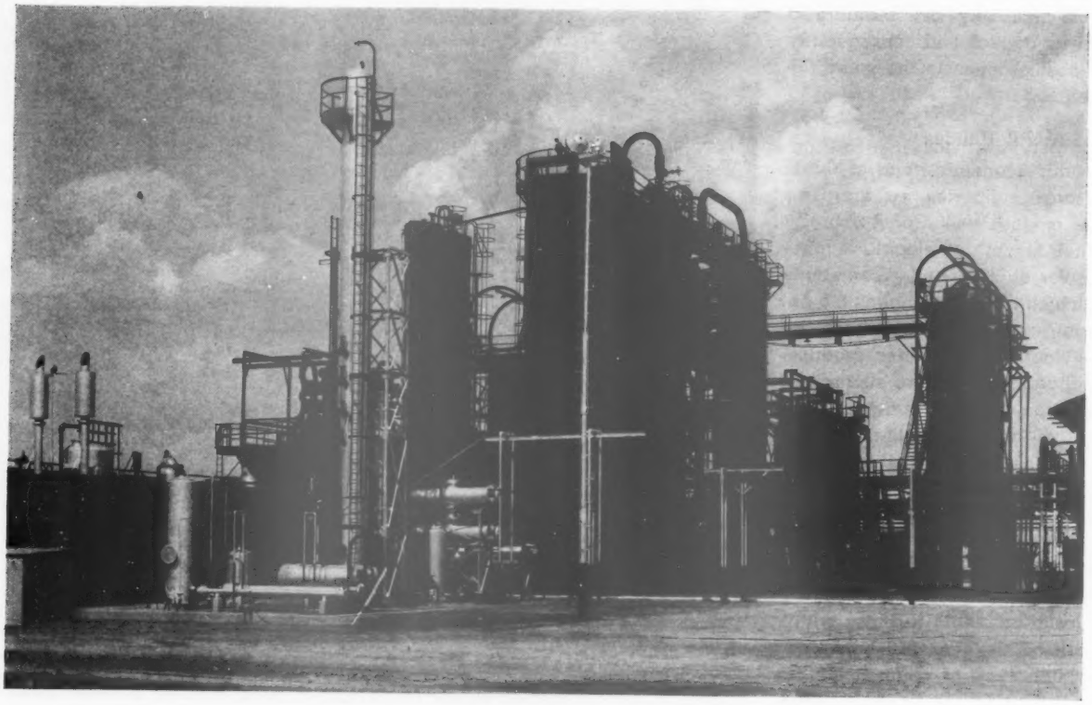
Sectional view of ventilated motor base

Divided Service

In the refinery, where this type of installation is being considered, it usually happens that utility power is already serving some portion of the electric load and, therefore, the additional energy required by the centrifugal hot-oil-charging pump can be considered to cost whatever the power-rate structure indicates as the lower incremental cost, which, after being properly evaluated, will permit utility power very often to prove more economical and show a short "payout" period over steam power or gas engines.

An interesting case came to hand recently which will illustrate the payout period desired for added equipment required in new processes. The question arose over the type of prime mover to install to operate a 1,500-hp. hot-oil-charging pump. The refiner was satisfied as to the constant-speed induction motor and the power-supply facilities which should almost guarantee continuous service.

The other types of prime movers considered were a back-pressure steam turbine (600 to 200 lb. per sq. in.) complete with boiler, and the gas engine with speed-increasing gears. The centrifugal pump was the same type considered in all three cases. The first cost of the three prime movers com-



REFINERIES *Save* WITH UTILITY ELECTRIC POWER

● *Skilled labor* is scarce—and if obtainable—expensive. *Taxes* are becoming increasingly numerous, complex, and burdensome. *Capital* is, in many cases, hard to find, or if available, may be used to much greater profit in other phases of the oil business.

Utility electric power—offering savings in ***plant investment*** and ***taxes*** and ***insurance,*** and providing for ***simple, flexible operation*** that doesn't require skilled workers and allowing for maximum speed in making plant additions—is more than ever essential to profitable refinery operation.

Our power engineers are anxious to be helpful. They are as near as your telephone. Call them in for a discussion of your power problems.

TEXAS ELECTRIC SERVICE COMPANY

plete, ready to operate with all appurtenances, was in the following ratio: Electric 1, steam 4, gas engines 5. The annual operating expense of each type of installation, exclusive of depreciation, was in the following ratio: Electric 1, steam 0.67, gas engines 0.71. The annual operating expense, exclusive of depreciation, when considered in relation to its installation cost for the three types of installations indicated that the following ratios existed: Electric 1.84, steam 0.29, gas engine 0.25.

Five-Year Payoff

Thus, while the electric operating cost appears higher in relation to the other installations of steam and gas engines, yet, the electric cost was sufficiently low enough that it would take well over 5 years to return the difference between the steam and electric investment. In the case of the gas engine, it would have taken 9 years to recover the difference in investment between its installation cost and the electric installation cost. The long payout periods of 5 and 9 years determined that the electric installation be selected. Thus, if the utility incremental power charges had been 15 per cent greater, the steam plant would have been installed, since the payout period would have been reduced to 3 years, which is somewhat in keeping with refiners' idea of proper economics. In this study, fuel was considered to cost 10 cents per million B.t.u., and the steam turbines had a water rate of 50 lb. of steam per b.hp.-hr.

1. In conclusion, it is definitely shown that the use of utility electric power is increasing each year in the refining industry.

2. Refiners apparently are not justified in making investments that require more than 3 or 4 years to retire.

3. The larger prime movers for oil-charging pumps will permit the selection of the electric motor, both from an economic standpoint and from a hazardous standpoint.

4. The manufacturer of electric equipment and the pump manufacturer have contributed greatly in making possible the use of motors in the refining industry.

5. The power utilities are eager for the refiners' business and make investments to provide good continuous service, and offer power schedules justifying more usage of their facilities.

6. Since the power utilities have available large surplus generating capacities, any defense program entered into by the refiner at this time, to manufacture aviation gasoline, toluene for explosives, or other materials required by the Army or Navy, for the relatively short period of the emergency, should permit the utilities to provide the refiner with ample electric-power facilities. The utilities are in much better shape financially at this time and also after the period of emergency to relieve the refiner of large investments in power plants necessary for such defense projects.

THERE IS ONLY ONE "QUALITY" GAUGE

It's very name is a description. The Ashcroft Quality Gauge has a patented rotary movement of phosphor bronze, monel bushings and monel link screws, with solid, one-piece connecting link. Accuracy—1% of scale.

Much extra value is built into the Ashcroft Quality Gauge. It will take plenty of abuse without showing wear or getting out of calibration.

You pay for "quality" in any gauge; why not be sure to get Ashcroft Quality Gauges?

Order from your local Jobber.

Branch Stocks in Tulsa and Los Angeles. Other branches in Dallas, Houston, Corpus Christi, New Orleans, New York, Chicago, Detroit

ASHCROFT GAUGES MANNING, MAXWELL & MOORE, INC. BRIDGEPORT CONNECTICUT

"Home Grown" IN AMERICA—THIS SUPREME TRACING CLOTH···BRUNING RIVAL

● The finest tracing cloth available—the one that passes *every* test of value—is made today in America by the same exacting standards that have won it nationwide fame! It is BRUNING RIVAL—a proved success on the drafting boards of the nation, and approved by thousands of American draftsmen.

Try Rival for yourself! Test it for uniformity of surface—for superior and lasting transparency—for easy erasing—for high tensile strength and durability. Find out how its greater workability can speed the job. A free, generous sample of Rival is yours for the asking. Just mail the coupon!

BRUNING *Since 1897*

SPEEDS—SIMPLIFIES—AND PROTECTS A NATION'S DRAFTING

New York • Chicago • Los Angeles • Boston • Detroit • Houston • Kansas City • Milwaukee
Newark • St. Louis • Pittsburgh • San Francisco • Seattle

CHARLES BRUNING CO., *Inc.* 1116-199B
New York: 100 Reade Street
Chicago: 445 Plymouth Court
Los Angeles: 919 So. Maple Avenue

I want to try BRUNING RIVAL tracing cloth for myself. Please send me, without charge or obligation, a generous working sample.

Name.....
Address.....
City..... *State*.....

Unusual Properties of Houdry Cracked Products Revealed

By H. P. BROOM
Catalytic Development Co.

THE Houdry catalytic cracking process has given the refining industry a new means for producing products of unusually high quality. Houdry catalytic gasoline is uniformly of 77-80 A.S.T.M. octane number and without regard to the source of the charge. Its corresponding research octane number generally ranges from 86-92. Lead susceptibility, road performance and stability are high; sulfur and gum content are low.

The catalytic gas oil from the once-through unit may be cracked thermally to gasoline yields that are equal to those obtained from fresh stocks of the same gravity-distillation characteristics, or it may be utilized in furnace oils. The gases produced are high in isobutane, thereby making them desirable for alkylation-plant feed stocks. Naphtha cuts of high solvency power may be taken from the Houdry synthetic crude stream.

The principal product of a modern refinery is motor fuel. Other products are usually produced in much less quantity and are, in that sense, by-products. The aim of every refiner, therefore, is to produce motor fuels requiring a minimum of addition agents such as gum inhibitors and octane improvers, since these increase manufacturing expense. Table 1 shows inspections of Houdry motor gasoline as produced currently in commercial plants. The motor method or A.S.T.M. octane numbers on the fuels range from 77 to 80 on that gasoline made by using natural clays as catalysts. On this same basis, however, gasolines of 78 to 81 octane value are produced from newly developed synthetic catalysts. The gasoline shown in the last column of Table 1 was produced in a plant using such a synthetic catalyst.

ment of a typical modern car at full throttle is compared with the performance of representative gasolines. The lower dotted curve shows the octane number of the standard reference fuel required to eliminate knock when the engine is paraffinic straightrun fuel performs at low speeds as a 68-octane fuel, and at high speeds as a 74-77-octane fuel. The leaded Mid-Continent straightrun and cracked fuel blend which is representative of many commercial gasolines performs as a 77-78-octane fuel at low speeds and as a 70-octane fuel at high speeds.

Each of these fuels is deficient in antiknock quality at low speeds, while at high speeds—particularly in the case of the straightrun—no use can be made of their antiknock quality. The Houdry gasoline is seen to fall well above even the maximum power requirement throughout the speed range. It may be considered almost "custom tailored" for the modern engine.

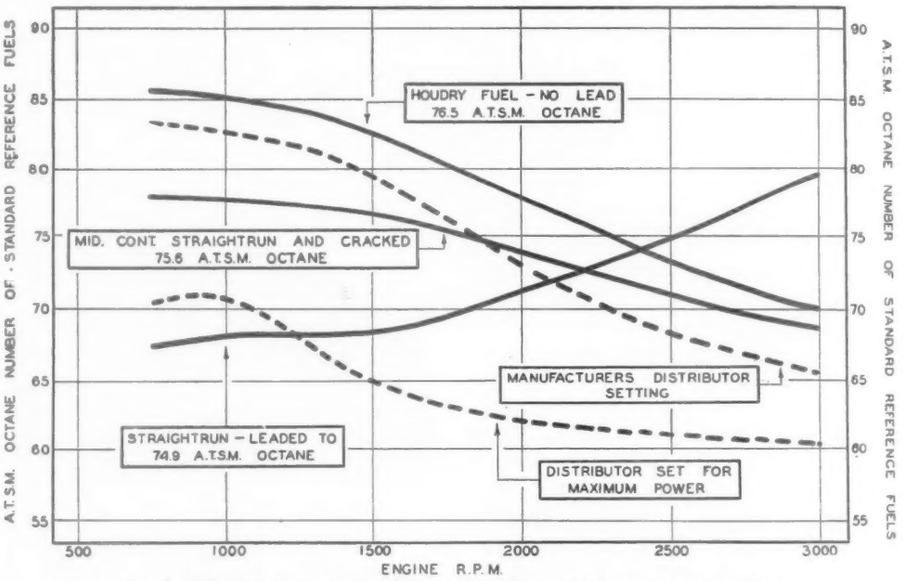

A.T.S.M. OCTANE NUMBER OF STANDARD REFERENCE FUELS
A.T.S.M. OCTANE NUMBER OF STANDARD REFERENCE FUELS
HOUDRY FUEL – NO LEAD
76.5 A.T.S.M. OCTANE
MID. CONT. STRAIGHTRUN AND CRACKED
75.6 A.T.S.M. OCTANE
MANUFACTURERS DISTRIBUTOR SETTING
STRAIGHTRUN – LEADED TO
74.9 A.T.S.M. OCTANE
DISTRIBUTOR SET FOR MAXIMUM POWER
ENGINE R.P.M.

Fig. 1—Influence of speed upon the motor-knocking tendencies of various fuels

TABLE 1—INSPECTIONS OF HOUDRY GASOLINE FROM OPERATING REFINERIES

Charge to Houdry unit—	Mid-Continent reduced crude	Illinois reduced crude	Kansas reduced crude	Mirando crude plus E. Texas red. crude	E. Texas and coastal residuum	Grade B coastal reduced crude	E. Texas and coastal gas oils
Gravity, °A.P.I.	57.6	61.8	55.0	54.5	54.7	56.9	52.8
Initial	101	97	92	90	88	94	79
10 per cent	137	124	148	143	126	126	126
50 per cent	251	222	270	271	264	254	271
90 per cent	379	347	379	373	390	398	398
End point	412	390	405	405	434	446	426
Reid vapor pressure	7.5	7.9	9.3	10.5	10.0	10.0	11.9
A.S.T.M. octane					80.2	78.5	80.4
1939 res. octane	87.4	87.9	87.6	87.0	92.4	88.6	88.0

Note: These gasolines are condensed, stabilized to vapor pressure, but do not contain any gasoline carried away by the wet gas.

Another characteristic of Houdry fuels is their flat octane-distillation curve as shown in Fig. 2 and compared with a fuel depending on lead for its octane. These data were obtained by distilling with a minimum of fractionation the two gasolines into 20 per cent cuts. The conclusion to be

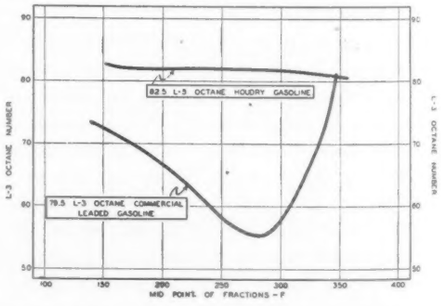


Fig. 2—Distribution of antiknocking tendencies of mid-fractions of fuels made by the Houdry catalytic-cracking process compared with that of a non-Houdry leaded commercial fuel

The octane number of Houdry gasoline as measured by the 1939 research method usually ranges from 86-92, depending upon the charge stock and the operating conditions of the plant. Road octanes as determined by the Uniontown method (described in S.A.E. Journal, May 1935) are between the research and motor-method figures, and are reported as closer to the research value and therefore higher than expected from relationships known to apply to other gasolines.

This superior road octane value seems to be accounted for by the Houdry gasoline's ability to meet the modern automobile's engine requirements. The most frequent maximum power requirement comes when accelerating at low speed. At this point most gasolines fail. This is shown graphically in Fig. 1, where the engine requirement is operated using the manufacturer's distributor setting. The range of engine speeds is extended from 750 to 3,000 r.p.m. This rate approximates 15 to 60 m.p.h. The upper dotted curve shows the reference-fuel requirement of the car when the distributor is set for maximum power. This would be, of course, the manufacturer's distributor setting if suitable fuels were generally available. From these two curves it can be seen that the octane requirement of an engine, as measured by standard reference fuels, decreases with speed.

The three solid curves show the performance of a typical Houdry gasoline plotted with two other types of commercial gasoline, all of them having about the same A.S.T.M. octane number. These curves show that the octane performance of fuels varies with engine speed. For instance, the leaded

drawn is that when using Houdry gasoline in a multicylinder engine the operator need not depend upon perfect distribution of the vaporized and unvaporized portions of the gasoline in order to eliminate knock. Table 2 is of special interest for it shows an analysis of a typical Houdry motor gasoline.

Up to 250° F. the aromatic content of the gasoline is low, and the high octane comes primarily from the isoparaffins. In the heavier range the proportion of aromatics and naphthenes increases.

If lead is used in the final marketed gasoline, the lead susceptibility of Houdry gasoline becomes important. This is in recognition of the relatively poor lead susceptibility of certain special high-octane fuels which depend upon high concentrations of olefins or aromatics, for their high octane values but which have inherently low lead responsiveness. Since Houdry gasolines are low in sulfur and high in paraffin content, their lead susceptibilities are good.

Table 3 gives lead susceptibilities of Houdry motor gasolines made from a variety of stocks. These show A.S.T.M. octane numbers of 83-86 when containing 1 c.c. TEL per gallon and 85-90 when 3 c.c. are used. Research octane values range from 92 to 95 when 1 c.c. is used, 95 to 98 when 3 c.c. are used. It should be noted that these gasolines have not been sweetened or treated in any manner.

The recent literature on high-octane fuels seems to stress their blending value with low-octane straightrun gasolines. Houdry gasolines are known to have a relatively high blending value but what is really significant is the octane value of the gasoline when blended in the refinery with ordinary cracked and straightrun fuels of about 70 octane. When used in this manner, Houdry gasolines have been found to blend about arithmetically, although the resultant road-test octane, for the reasons outlined previously, is usually high.

In addition to its relatively low sulfur content and high octane values, Houdry gasoline possesses exceptionally long stability when compared with cracked gasoline generally. The oxygen-bomb induction period of the Houdry gasoline is usually 10 hours or more. In many of the existing installations the catalytic gasoline is given no treatment for stability but is doctor sweetened and blended with the straightrun and thermally cracked gasolines. The treating requirement depends upon the charge stock and the desired quality of the product. Houdry gasoline itself requires no inhibitors and the inhibitor requirements of a blended gasoline are low.

Table 4 gives inspections of representative stabilized Houdry motor gasolines. The volatility of each fuel is clearly demonstrated and is of particular interest in view of the high octane of the heavy ends of Houdry gasoline.

Cut for Octane Value

Generally it is necessary to cut early many cracked and straightrun fuels in order to get a high-octane product. With no drop in octane value as the end point of the Houdry gasoline is increased, it is to the advantage of the refiner to take a heavy Houdry gasoline cut, especially since there is ample front-end volatility. Table 1 shows gasolines having end points well over 400° F.

The characteristics of Houdry catalytic gas oil, or recycle stock, add greatly to the refinery's operating flexibility. Catalytic recycle stock is cleaner than thermal recycle stock for any given gasoline yield. It may be thermally cracked, used as furnace oil, or blended to cut the viscosity and pour point of heavy fuels. Table 5 gives inspections of catalytic gas oils made from various types of charge stocks.

These gas oils can be cut by distillation into fractions meeting the various furnace-oil specifications. Large quantities of Houdry cycle stocks have been marketed as household heating oils and these have come from a wide variety of crudes.

While high-speed diesel engines may require fuels with cetane numbers of 50 or better, medium-speed engines require only about 40 cetane number, and low-speed diesels may operate on fuel of 30 or less. Of the order of 90 per cent of the diesel horsepower of the country comes under these latter two classifications, and require a fuel

TABLE 2—COMPOSITION OF HOUDRY GASOLINE PRODUCED BY CRACKING EAST TEXAS GAS OIL

Cut No.	Boiling range, °F.—	Cut Volume per cent of gasoline	Analysis of cut (volume per cent of cut) Naphthene	Olefin	Paraffin	Aromatic
1	Below 50	8.3	0.0	15.0	85.0	0.0
2	50-104	11.5	0.0	7.5	92.4	0.0
3	104-158	11.9	18.7	7.5	77.8	0.0
4	158-212	11.2	40.3	7.0	47.7	5.0
5	212-257	9.9	37.2	6.3	32.8	23.7
6	257-302	12.9	30.8	3.7	23.2	42.3
7	302-347	18.8	27.0	2.5	26.0	44.5
8	347-392	15.5	39.9	1.8	21.1	37.2
	Per cent of total gasoline	100.0	25.6	5.6	46.3	22.5

TABLE 3—LEAD SUSCEPTIBILITIES OF HOUDRY MOTOR GASOLINES

Charge stock—	East Texas gas oil	East Texas, Rodessa and coastal cracking stock		California high sulfur gas oil	East Venezuela gas oil	Reduced Illinois crude	Mirando crude	44 % bottoms E. Texas crude
A.S.T.M. octanes:								
0 c.c. TEL per gal.	80.9	78.0	79.9	78.0	79.4	77.4	80.7	79.8
1 c.c. TEL per gal.	86.2	83.5	...	82.7	...	...	84.5	82.9
3 c.c. TEL per gal.	90.1	87.5	...	85.4	89.3	...	89.2	84.9
1939 res. octanes:								
0 c.c. TEL per gal.	...	85.2	91.2	...	...	89.3	90.6	91.5
1 c.c. TEL per gal.	...	92.6	94.8	...	...	92.9	...	...
3 c.c. TEL per gal.	...	96.5	98.4	...	...	95.0	...	...

TABLE 4—HOUDRY STABILIZED MOTOR GASOLINE

Charge stock—	East Texas, Rodessa and coastal pressure-still stock		California high-sulfur fuel	Illinois reduced crude	E. Texas gas oil
Gravity	61.7	59.6	55.7	56.8	64.0
Initial	90	92	95	79	86
10 per cent	122	123	129	125	112
20 per cent	141	145	156	157	130
30 per cent	162	168	186	185	141
40 per cent	184	194	215	216	180
50 per cent	208	219	244	245	209
60 per cent	236	244	279	274	238
70 per cent	270	273	308	304	268
80 per cent	306	304	340	329	302
90 per cent	346	348	371	378	340
End point	408	406	419	413	390
R.v.p. at 100° F.	10.0	10.0	9.8	10.4	10.5
Sulfur	.03	.03	.15	.03	.01
Oxygen bomb ind. per hr.	10+	10+	10+	10+	10+
C.F.R.M. octane	80.0	79.9	81.2	77.4	80.0
C.F.R.M. octane plus 1 c.c. TEL	...	...	...	...	86.0
C.F.R.M. octane plus 3 c.c. TEL	...	...	...	...	90.0
C.F.R.R. octane	89.1	91.2	...	89.3	...
C.F.R.R. octane plus 1 c.c. TEL	...		...	92.9	...
C.F.R.R. octane plus 3 c.c. TEL	98.2	98.4	...	95.0	...

Note: These gasolines contain the C_5-and-heavier fractions recoverable from the wet gas.

TABLE 5—INSPECTION OF CATALYTIC GAS OILS FROM HOUDRY-PROCESSING VARIOUS STOCKS

Inspection of Houdry catalytic cracking stock:	Charge to Houdry unit: East Texas gas oil	E. Texas, Rodessa and coastal cracking stocks	California high-sulfur gas oil	East Venezuela gas oil	40% bottoms Conroe crude	Reduced Illinois crude	Mirando crude	Reduced Mid-Continent crude	Reduced E. Texas crude
Gravity, °A.P.I.	32.7	27.1	23.3	28.6	27.9	31.0	24.2	30.0	29.4
Initial	436	424	446	420	455	451	408	444	448
10 per cent	466	492	470	448	498	495	456	474	486
20 per cent	479	518	490	465	517	520	468	494	512
30 per cent	486	534	...	477	533	541	478	508	540
40 per cent	492	560	...	488	547	560	488	524	560
50 per cent	500	580	529	502	563	580	502	542	576
60 per cent	514	604	...	517	581	603	518	568	600
70 per cent	528	630	...	534	600	634	532	596	626
80 per cent	552	660	...	558	624	668	556	628	664
90 per cent	584	708	640	596	662	724	596	676	710
End point	678	752	735	704	742	760+	707	760+	760+
Recovery	98	97	98	98	98	94	99	96	94
Res.	...	...	1.0	...	...	...	0.8	1.8	3.0
An. pt., °F.	136	136	98	119	139	...	124	140	148
S.U. vis. at 100° F.	35	39	37	35	39	40	36	39	32
Con. carbon	0.05	.22	.12	.08	.05	.09	.08	...	...
Pour point, °F.	+20	+40	+5	+5	+45	+45	—36	+40	+60
Sulfur	.15	.30	.51	.48	.13	.24	.09	.12	.21

TABLE 6—PROPERTIES OF HOUDRY CATALYTICALLY CRACKED FUEL OILS

Charging stocks—	Frio County crude	Healdton gas oil	Oklahoma City gas oil	Pennsylvania crude
Properties:				
A.P.I. gravity	25.6	32.9	32.8	38.7
A.S.T.M. distillation:	°F.	°F.	°F.	°F.
Initial	437	468	448	435
5 per cent	...	...	...	...
10 per cent	506	496	487	472
20 per cent	...	...	500	485
30 per cent	...	...	510	497
40 per cent	...	...	524	508
50 per cent	...	...	536	520
60 per cent	...	...	551	532
70 per cent	...	...	566	546
80 per cent	...	...	586	568
90 per cent	620	594	611	599
End point	646	620	694	652
Per cent recovery	...	...	...	...
Per cent residue	...	...	...	...
Pour point, °F.	15	15	15	10
Flash, P.M., °F.	154	220	...	...
Sulfur, per cent by wt.	1.17	0.40	...	...
S. U. vis. at 100° F. (sec.)	39.0	38.0	39.0	39.0
Carb. res., per cent by wt.	0.02	0.07	0.09	0.12
Aniline No., °F.	114	150	146	160
Diesel index	29.2	49.3	47.9	62.0
Cetane number	40	52	55	62

of no higher than 45 cetane number. Catalytically cracked diesel fuels from a majority of Houdry charge stocks will fall in this classification. Table 6 gives properties of four diesel fuels produced by Houdry cracking the stocks shown. Three of these are of higher cetane number than the average of Houdry stocks, but show that from the proper charge diesel fuels of as high as 60 cetane number can be obtained. About 45 per cent of gasoline was produced from the case charge stock when these fuels were produced.

All or any part of the catalytic gas oil produced by Houdry cracking operations may be charged to thermal cracking units, and as the accompanying Fig. 3 (reproduced from "Economic Factors in Catalytic Cracking," by Carey and Ortendahl) shows, will give yields about the same as fresh stocks of the same gravity-distillation characteristics. Table 7 gives an example of the flexibility possible with both Houdry and thermal units. In the case of the Oklahoma City gas oil shown, a 65.9 per cent yield of gasoline was obtained thermally, and the motor-method octane number was 71. By running the same stock in a Houdry unit, taking a 40 per cent gasoline yield, and subsequently running the cycle stock in a thermal unit, the gasoline yield was raised to 73.5 per cent, and the overall octane to 74.3. One point of interest in the data of this table is the fact that the Houdry cycle stock, even after a 40 per cent yield had been taken, still gave 61 per cent of gasoline in the thermal unit, only 4.9 per cent lower than the fresh stock.

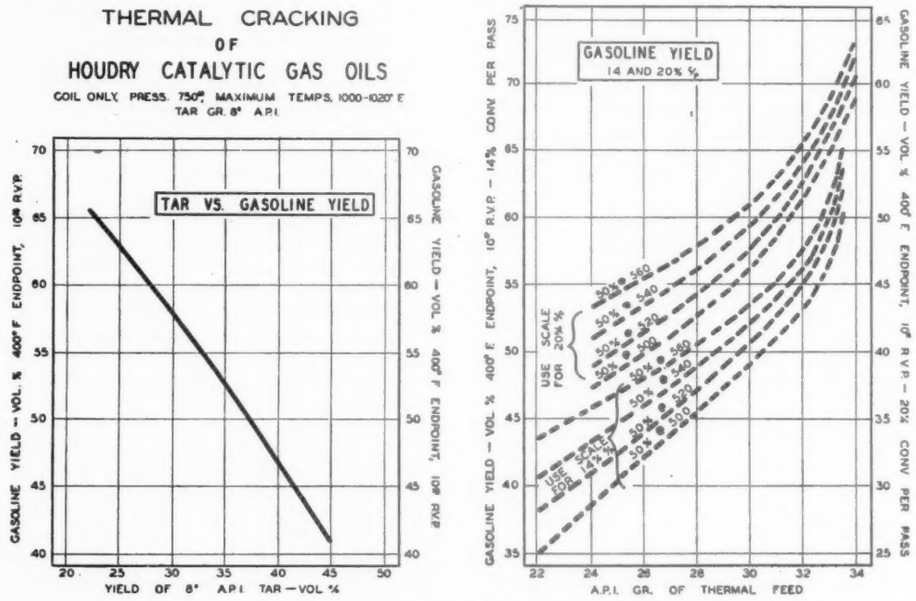

THERMAL CRACKING
OF
HOUDRY CATALYTIC GAS OILS
COIL ONLY. PRESS. 750#. MAXIMUM TEMPS. 1000-1020° F
TAR GR. 8° A.P.I.
TAR VS. GASOLINE YIELD
GASOLINE YIELD — VOL. % 400° F ENDPOINT, 10# RVP
GASOLINE YIELD — VOL. % 400° F ENDPOINT, 10# RVP
YIELD OF 8° A.P.I. TAR — VOL %
GASOLINE YIELD
14 AND 20% %
GASOLINE YIELD — VOL. % 400° F ENDPOINT, 10# R.V.P. — 14% CONV PER PASS
GASOLINE YIELD — VOL. % 400° F ENDPOINT, 10# R.V.P. — 20% CONV PER PASS
USE SCALE FOR 20% %
USE SCALE FOR 14% %
A.P.I. GR. OF THERMAL FEED

Fig. 3—Yields from Houdry catalytically cracked gas oil

TABLE 7—PROCESSING OKLAHOMA CITY GAS OIL

	Thermal operation	Houdry followed by thermal operation
Total gasoline yield, per cent volume of fresh gas oil	65.9	73.5
C.F.R.M. octane of total gasoline	70.8	74.3
Tar yield, per cent volume of fresh gas oil	21.7	15.1
Tar gravity, °A.P.I.	7.6	8.0
Gas and loss (by difference)	12.4	11.4
Yield on Houdry operation:		
Gasoline, per cent volume of fresh gas oil	....	40.0
Recycle stock, per cent volume fresh gas oil	....	55.0
Gas and loss (by difference)	....	5.0
Yield on thermal operation:		
Gasoline, per cent of charge to thermal coil	65.9	61.0
Tar, per cent of charge to thermal coil	21.7	27.5
Inspection of thermal gasolines:		
A.P.I. gravity	58.7	60.0
10 per cent	126	125
50 per cent	245	248
90 per cent	369	369
R.v.p. at 100° F.	9.4	10.2
C.F.R.M. octane	70.8	71.1
Inspection of charge to thermal unit:	Fresh gas oil	Houdry catalytic gas oil
A.P.I. gravity	35.1	33.6
10 per cent	507	505
50 per cent	572	578
90 per cent	630	649
Aniline point, °F.	169	162
Conradson carbon residue	0.03	0.03
Viscosity, S.S.U. at 100° F.	40.7	41.6
Pour point, °F.	20	15

Desulfurization

Another point to be considered in the thermal processing of Houdry cycle stocks is that desulfurization takes place in the catalytic reaction. The resulting cycle stock usually has a lower sulfur content than the virgin charge stock. This is reflected in the production of lower-sulfur-content thermal gasolines than when fresh stock is charged and thus in turn results in further saving of tetraethyl lead.

Table 8 shows the sulfur content of a range of Houdry case charge stocks and the catalytic gas oil from each.

TABLE 8—SULFUR CONTENT OF HOUDRY CATALYTIC GAS OILS COMPARED TO SULFUR CONTENT OF CHARGING STOCKS

	Sulfur content	
	Houdry case charge	Houdry catalytic gas oil
Mirando-Coastal red. crudes	.16	.09
Illinois-Michigan red. crude	.32	.19
East Texas red. crude	.41	.27
Venezuela gas oil	.62	.48
California red. crude	.87	.50

The dry gas produced over a 10-lb. R.v.p. gasoline is usually heavier than that produced by thermal operations, the specific gravity usually running from 1.2 to 1.6. The butane-butene content of this gas may be in excess of 50 per cent by weight. Of the butanes produced, 80-85 per cent is generally isobutane, which is now a scarce and unusually desirable feed component for an alkylation plant.

The butylenes may be as low as 10 per cent of the C_4 cut when reforming or cracking light gas oils, or over 50 per cent when cracking reduced crudes or residuums.

While not a catalytic product, the tar which is left when charging reduced crudes is nevertheless a product and must be disposed of commercially. The tar yield varies with the crude source.

The method of disposal of the tar depends on the character of the stock and on local refinery conditions. The methods in commercial use at present are:

1. Viscosity break to produce gasoline and No. 6 fuel oil.
2. Coke in conventional equipment.
3. Blend with tar from thermal operations to cut viscosity.
4. Reduce to asphalts and binders.
5. Burn as refinery fuel.

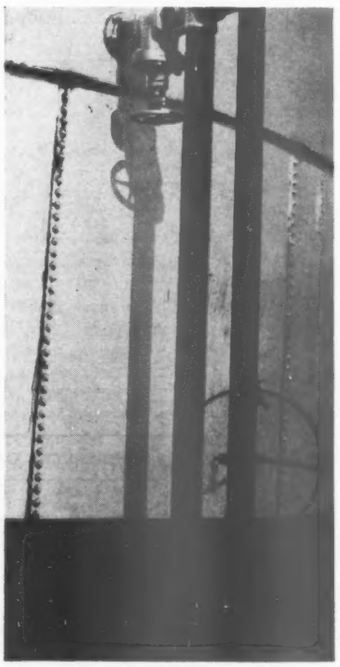
In regard to Method 3, the tar produced when cracking the Houdry catalytic gas oil in a thermal unit is generally of low-enough viscosity to blend the fresh Houdry tar to a salable fuel without calling upon other refinery operations.

The author wishes to acknowledge the assistance of G. S. Dunham, T. P. Simpson, H. D. Noll, E. T. Scafe and J. Happel of the Socony-Vacuum Oil Co., and of Dr. J. B. Hill and A. L. Clayden of the Sun Oil Co. in making available certain data used herein.

Fixed Step for Elevated Valve

When a tank valve must be set too high for ready manipulation from the ground the usual practice is to set a short stand nearby. This usually invites danger.

Here is shown a permanent and safe installation. It is a wide step bolted to a pipe adjacent to the pipe on which the elevated valve is located. From here the handwheel can be readily turned. The plate on the step is made safer by roughening the tread. This is done by welding wavy lines of metal across it to assure safe footing.



The step, being clamped to the pipe instead of welded thereto, may be removed or loosened if it becomes necessary.

Personnel of United States Refineries

A

Advance Refining Co., Inc., Box 407, Centralia, Ill.

Maynard Taxman, *Pres.* M. M. Cohen, *V. P.* Marwyn Cohen, *Sec.* Milo W. Taxman, *Treas.* and *Sales Mgr.* George M. Pfau, *Gen. Mgr. Ref.* V. U. Cloer, *Ch. Chem.* C. W. Hulland, *Pur. Agt.* and *Traf. Mgr.* Refinery located at Centralia, Ill.

Aerex Co., The, Bloomfield, N. M.

A. C. Kittell, *Pres.* and *Sales Mgr.* V. A. Kittell, *V. P.* G. D. Noland, *Sec.* W. J. Wylie, *Res. Supt.* Refinery located at Bloomfield, N. M.

Aero Gas & Refining Co., Fort Stockton, Tex.

J. C. Williams, *Gen. Mgr.* Refinery located at Fort Stockton, Tex.

Aetna Oil Co., 1202 S. Third St., Louisville, Ky.

W. R. Abbott, *Pres.* W. T. Davis, *Exec. V. P.* C. M. Alexander, *V. P. chg. Mfg. & Trans.* J. B. Hutchinson, *V. P. chg. Sales.* Andres J. Brewer, *Sec.* and *Treas.* A. L. Edsel, *Sales Mgr. Whsle.* S. E. Towery, *Sales Mgr. Retl.* E. E. Van Buren, *Ref. Supt.* Malden Michael, *Ch. Chem.* J. M. Vyn, *Ch. Engr.* Dan Constant, *Pur. Agt.* H. J. Flanders, *Traf. Mgr.* Refinery located at Louisville, Ky.

Albany Oil & Refining Co., Box 443, Laramie, Wyo.

N. A. Swenson, *Pres.* and *Gen. Mgr.* H. N. Roach, *V. P.* Dr. H. H. Horton, *Sec.* and *Treas.* H. J. Metzgar, *Sales Mgr.* E. J. Nininger, *Gen. Supt.* Plant located at Laramie, Wyo.

Allegany Refiners, Inc., Bolivar, N. Y.

A. L. Shaner, *Pres.* Chas. A. Chipman, *V.P.* and *Sec.* D. V. McCarty, *V.P.* E. E. Slingerland, *Treas.* H. W. Walchli, *Gen. Mgr. Ref.* A. Wickham, *Ref. Supt.* Harold Button, *Asst. Supt.* C. A. Jordan, *Pur. Agt.* and *Traf. Mgr.* Refinery located at Bolivar, N. Y.

Allied Materials Corp., 507 Cotton Exchange Bldg., Oklahoma City, Okla.

T. A. Nicholson, *Pres.* C. W. Barbour, *V. P.* E. E. Donnay, *Sec.* and *Treas.* T. A. Pomeroy, *Gen. Supt.*; Walton Moore, *Asst. Supt.*; Edward Baker, *Ch. Chem.*, Stroud, Okla. Refinery located at Stroud, Okla.

Allied Oil Corp. of Illinois, Box 367, St. Elmo, Ill.

A. R. Matthews, *Pres.* L. B. Stableford, *V. P.* W. H. Rice, Jr., *Sec.* and *Treas.* C. L. Withers, *Gen. Supt.* and *Pur. Agt.* Leroy Gunnerson, *Ch. Chem.* I. Pilkington, *Traf. Mgr.* Refinery located at St. Elmo, Ill.

Allstate Refining Co., Peoples Bank Bldg., Tyler, Tex.

H. H. Coffield, *Pres.* George P. Mann, *V. P.* J. H Edwards, *Sec.* Refinery located at Thrall, Tex.

American Petroleum Co. (Texas), Petroleum Bldg., Houston, Tex.

G. O. Irvine, *Pres.* T. J. Arnold, *V. P.* G. L. Townsan, *Sec.* C. T. Carnes, *Treas.* J. M. Cook, *Sales Mgr.* S. J. Bell, *Gen. Supt. Ref.* H. P. Sellers, *Ch. Chem.* J. H. Bringhurst, *Ch. Engr.* W. G. Freitag, *Pur. Agt.* H. W. McCollum, *Traf. Mgr.* Refinery located at Houston (Norsworthy Terminal), Tex.

Amsco Refining Co., Box 2391, Corpus Christi, Tex.

Kent W. Bartlett, *Pres.* John D. Manley, Ward C Pearl, John A. Bartlett, *V. P.s.* Harold Pearson, *Sec.* Forest R. Lowrey, *Treas.* John A. Bartlett, *Gen. Mgr. Ref.* E. G. Mehlburger, *Gen. Supt. Ref.* G. C. Allison, *Ch. Chem.* J. U. Sheppard, Jr., *Ch. Engr.* Fred Geiger, *Pur. Agt.* R. Wennerskold, *Traf. Mgr.* Refinery located at Corpus Christi, Tex.

Anco Refining Co., Garrett, Kans.

Refinery located at Garrett, Kans.

Anderson-Prichard Refining Corp., 1000 Ramsey Tower, Oklahoma City, Okla.

L. H. Prichard, *Pres.* J. Steve Anderson, *V. P.* P. H. Anderson, *V. P.* and *Treas.* T. H. Marshall, *Sec.* C. H. Dresser, *Sales Mgr. Asphalts* and *Technical Naphthas.* C. L. Mayhall, *Sales Mgr. Refined Oils.* George H. Burruss, *Gen. Mgr. Ref.* J. C. Bradley, Cyril, *Ref. Supt.* B. I. Scoggin, Jr., *Mgr. R. & D.* C. A. Prichard, *Pur. Agt.* Refinery located at Cyril, Okla.

Arkansas Fuel Oil Co., P.O. Box 1734, Shreveport, La.

T. W. Tutwiler, *Pres.* D. W. Harris, *V. P.* and *Gen. Mgr.* A. F. Holliday, J. A. Welch, *V. P.s.* J. S. Sheffield, *Sec.* M. J. Lasseigne, *Treas.* A. H. Weyland, *Gen. Supt.* J. A. Welch, *Sales Mgr.* R. B. Pierce, *Mgr. Ref.* H. R. Smith, *Ref. Supt.* G. W. Wilbur, *Asst. Supt.* A. W. Trusty, *Ch. Chem.* H. T. Goss, *Ch. Engr.* C. B. Whyte, *Ref. Ch. Engr.* J. Lucas, *Pur. Agt.* E. M. Hinkle, *Traf. Mgr.* Refinery located at Bossier City, La.

ABBREVIATIONS USED

Chm. Bd.—Chairman of Board.
Pres.—President.
V. P.—Vice President.
Sec.—Secretary.
Treas.—Treasurer.
Sales Mgr. Whsle.—Sales Manager Wholesale.
Sales Mgr. Retl.—Sales Manager Retail.
Gen. Mgr. Ref.—General Manager of Refining.
Gen. Supt. Ref.—General Superintendent of Refining.
Ref. Supt.—Refinery Superintendent.
Asst. Supt.—Assistant Superintendent.
Mgr. R. & D.—Manager of Research and Development.
Ch. Chem.—Chief Chemist.
Ch. Engr.—Chief Engineer.
Pur. Agt.—Purchasing Agent.
Traf. Mgr.—Traffic Manager.

Aromalene, Inc., 1840 E. Twenty-ninth St., Long Beach, Calif.

J. L. Crawford, *Pres.* G. A. Weeden, *V. P.* M. C. Valdes, *Sec.* and *Treas.* J. L. Crawford, *Gen. Mgr. Ref.* M. C. Valdes, *Ch. Engr.* G. A. Weeden, *Pur. Agt. (crude).* Refinery located at Long Beach, Calif.

Arro Oil & Refining Co., 605 Montana Bldg., Lewistown, Mont.

H. H. Schwartz, *Pres.* Ed L. Allen, *V. P., Treas.*, and *Gen. Mgr.* Guy R. Enlow, *Sec.* Thomas R. Gilmour, *Sales Mgr.* Paul Jones, *Gen. Supt.* Paul Cooper, *Asst. Supt.* and *Ch. Chem.* Refinery located at Lewistown, Mont.

Ashland Oil & Refining Co., 1409 Winchester Ave., Ashland, Ky.

James L. Martin, *Chm. Bd.* Paul G. Blazer, *Pres.* W. H. Keffer, *V.P.* E. F. Wells, *V.P.* and *Sales Mgr. Whsle.* E. L. McDonald, *Sec.-Counsel.* S. M. Burnam, *Asst. Sec.-Counsel.* E. W. Seaton, *Treas.* A. A. Hines, *Sales Mgr. Retl.* F. W. Irwin, *Gen. Supt. Ref.*; H. A. Blackstone, *Asst. Supt.*; John S. Pfarr, *Mgr. R. & D.*; F. Leo Bever, *Ch. Engr.*, Catlettsburg. Alex S. Chamberlain, *Personnel Mgr.*; M. C. Dupree, *Trans. Mgr.*; M. K. Lovell, *Pur. Agt.*; P. H. Banks, *Traf. Mgr.*, Ashland. Refinery located at Catlettsburg, Ky.

Atlantic Refining Co., The, 260 Broad St., Philadelphia, Pa.

Robert H. Colley, *Pres.* E. H. Blum, Robert C. Tuttle, A. A. Garrabrant, W. M. Irish III, *V.P.s.* W. D. Anderson, *V.P.* and *Export Sales Mgr.* E. J. Henry, *V.P.* and *Gen. Mgr. Ref.* W. C. Yeager, *V.P.* and *Domestic Sales Mgr.* W. M. O'Connor, *V.P.* and *Sec.* Paul Shuman, *Treas.* H. M. Nichols, *Plant Mgr.*; D. T. Shaw, *Asst. Supt.*, Philadelphia. M. J. Welsh, *Plant Mgr.*; R. Stewart, *Asst. Supt.*, Port Arthur, Tex. H. V. Hume, *Light Oil Dept.*; R. P. Horner, *Lubrication Dept.*; W. B. Hart, *Gas, Acid & Drainage Dept.*; C. J. Cutting, *Heat, Light & Power Dept.*; F. W. Anderson, *Mech. Dept., Supts.* T. G. Delbridge, *Mgr. R. & D.* H. M. Hancock, *Supt. Inspection Dept.* L. M. Goldsmith, *Ch. Engr.* J. S. Parks, *Pur. Agt.* H. G. Schad, *Traf. Mgr.* Refineries located at 3144 Passyunk Ave., Philadelphia, and Port Arthur (Atreco), Tex.

Atlas Pipe Line Corp., Atlas Bldg., Shreveport, La.

H. R. Phelps, Jr., *Trustee.* B. F. Connolly, *Gen. Mgr. for Trustee.* J. W. Shemwell, *Sales Mgr.* V. B. Chance, *Gen. Supt. Ref.* Abe Wizig, *Ch. Chem.* Robert Nix, *Pur. Agt.* (Company is in process of reorganization). Refinery located at Shreveport, La.

Atlas Refining Co., 5776 Cherry Ave., North Long Beach, Calif.

J. H. Thomas, *Pres.* J. D. Thomas, *Sec.* and *Treas.* Dean Thomas, *Gen. Mgr.* Refinery located at North Long Beach, Calif.

Aurora Gasoline Co., 15911 Wyoming Ave., Detroit, Mich.

Wm. E. Slaughter, Jr., *Pres.* Henry E. Wenger, *V.P.* Max M. Fisher, *Sec.* and *Sales Mgr.* L. Curran, *Gen. Supt.* O. A. Potter, R. Scott, *Ref. Supts.* H. Erickson, *Ch. Chem.* I. R. Schiff, *Traf. Mgr.* Refineries located at Detroit and Elsie, Mich.

B

Baird Refining Co., Box 1088, Baird, Tex.

J. R. Parten, *Chm. Bd.* Myron G. Blalock, *Pres.* Sylvester Dayson, *Gen. Mgr.* D. C. Biggers, *Sec.* R. P. Hargis, *Treas.* E. L. Woodley, *Sales Mgr.* L. G. Dufilho, *Gen. Supt.* J. B. Misenheimer, *Process Supt.* J. E. Bullock, *Pur. Agt.* Refinery located at Baird, Tex.

Baker Petroleum Corp., 414 Beneficial Life Bldg., Salt Lake City, Utah.

C. W. Buskirk, *Engr.* Plant located at Virgin, Utah.

Barber Asphalt Corp., Barber, N. J.

J. E. Auten, *Pres.* Frank Seamans, *V. P.* E. R. Riter, *Sec.* F. J. Robertson, *Treas.* R. L. Gesner, *Sales Mgr.* L. E. Briese, *Gen. Mgr. Ref.* H. J. Fleischer, *Supt.*; L. S. Schleck, *Asst. Supt. Oil Refinery.* Percy Palmer, *Supt.*, asphalt refinery. Howard V. Smith, *Mgr. R. & D.* H. C. Howell, *Ch. Chem.* J. S. Parker, *Ch. Engr.* A. J. Hollenbach, *Pur. Agt.* C. Holdsworth, *Traf. Mgr.* Refinery located at Barber, N. J.

Bareco Oil Co., Box 2009, Tulsa, Okla.

O. L. Cordell, *Pres.* G. F. Racette, *V. P.* D. L. Frawley, *V. P.* E. R. Atwill, Jr., *Sec.* and *Pur. Agt.* C. E. Votrian, *Treas.* G. F. Racette, *Sales Mgr.* O. L. Cordell, *Gen. Mgr. Ref.* F. S. Horne, *Ref. Supt.*, Barnsdall. V. R. Oakley, *Ref. Supt.*, Wichita. A. B. Comstock, *Ref. Supt.*, Corpus Christi. E. R. Wiles, *Asst. Supt.* and *Ch. Chem.*, Barnsdall. R. E. Stewart, *Traf. Mgr.* Refineries located at Wichita, Kans., Barnsdall, Okla., and Corpus Christi, Tex.

Basin Oil Refining Co., Box 477, Centralia, Ill.

A. R. Matthews, *Pres.* L. B. Stableford, *V. P.* W. H. Rice, Jr., *Sec.* and *Treas.* C. L. Withers, *Gen. Supt. Ref.* C. W. McCormack, *Supt. Ref.* Refinery located at Centralia, Ill.

Basin Refining Co., Box 96, Aztec, N. M.

D. J. Lingenfelter, *Owner.* Charles Riecke, *Supt.* Refinery located at Aztec, N. M.

Bayou State Oil Corp., 726 Ardis Bldg., Shreveport, La.

P. M. Brown, *Pres.* S. M. Cook, *V. P.* F. M. Cook, *Sec.* and *Treas.* W. T. Leeper, *Sales Mgr. Whsle.* P. M. Brown, *Gen. Mgr. Ref.* H. J. Sheard, T. N. Reed, *Gen. Supts.* F. D. Coons, *Pur. Agt.* and *Traf. Mgr.* Refinery located at Hosston, La.

Bay Petroleum Corp., The, Box 957, Denver, Colo.

C. U. Bay, *Pres.* Roland V. Rodman, *V. P.* Dent N. Hand, *Sec.* and *Treas.* W. R. Newman, *Gen. Supt. Ref.* M. C. Bradshaw, *Sales Mgr.*; Carl Orrison, *Supt.*; A. A. Vendetti, *Ch. Chem.*, McPherson. L. L. Leabo, *Sales Mgr.*; C. O. Garbrecht, *Supt.*; Ray Ainsworth, *Ch. Chem.*, Denver. Refineries located at McPherson, Kans., and Denver, Colo.

Bay Refining Corp., 212 Beringer Bldg., Saginaw, Mich.

James C. Graves, *Pres.* Howard D. Atha, *V. P.* Edward Reiser, *V. P.* and *Gen. Mgr.* T. G. Caley, *Sec.* and *Treas.* Kenneth Patterson, *Sales Mgr.* Frank Tiernan, *Gen. Supt.* Refinery located at Bay City, Mich.

Beacon Oil Ref. Co., Box 241, Henderson, Tex.

T. P. Cannon, *Pres., Treas.* and *Gen. Mgr.* Mrs. Alice M. Roberts, *V. P.* T. A. Garnett, *Sec.* L. H. Barbee, *Gen. Supt. Ref.* Refinery located at Henderson, Tex.

Bears Den Refinery, Chester, Mont.

F. E. Barkley, *Owner.* Plant located at Chester, Mont.

Beck Refinery, Box 348, Cody, Wyo.

George T. Beck, *Owner.* W. M. Taylor, *Gen. Mgr. Ref.* Refinery located at Cody, Wyo.

Belle Refining Co., Sundance, Wyo.

A. Policky, *Sales Mgr. Whsle.* Frank Policky, *Sales Mgr. Retl.* Ralph Watson, *Gen. Mgr. Ref.* John Prestes, Belle Fourche, S. D., *Supt.* Lyle Watson, *Asst. Supt.* Refinery located at Belle Fourche, S. D.

Bell Oil & Gas Co., 1310 Natl. Bank of Tulsa Bldg., Tulsa, Okla.

Samuel L. Lubell, *Pres.* Benedict I. Lubell, *V. P.*

and *Treas.* Dr. I. Arthur Anson. *V. P.* and *Gen. Mgr. Ref.* M. Lloyd Freese, *V. P.* B. P. Piepgrass, *Sec.* L. H. Deatherage, *Sales Mgr.* A. M. Moore, *Ref. Supt.* Grant Jarrell, *Ch. Chem.* J. H. Naron, *Pur. Agt.* C. E. Cadieux, *Traf. Mgr.* Refinery located at Granfield, Okla.

Ben Franklin Refining Co., 1310 Natl. Bank of Tulsa Bldg., Tulsa, Okla.

Dr. I. Arthur Anson, *Pres.* and *Gen. Mgr.* M. Lloyd Freese, *V. P.* Benedict I. Lubell, *V. P.* and *Treas.* Ben P. Piepgrass, *Sec.* L. H. Deatherage, *Sales Mgr.* E. S. Horner. *Ref. Supt.* F. V. Clark, *Ch. Chem.* J. H. Naron, *Pur. Agt.* C. E. Cadieux, *Traf. Mgr.* Refinery located at Ardmore, Okla.

Berry Asphalt Co., 1472 W. 76th St., Chicago, Ill.

Charles S. Bird, *Chm. Bd.* B. H. Roberts, *Pres.* H. B. Pullar, *V. P.* and *Gen. Mgr.* A. H. Anderson, *Sec.* and *Treas.* Chester Eberle, *Sales Mgr.* A. T. Van Pelt, *Gen. Supt.* Homer J. Sarrett, *Asst. Supt.* Roland Vokac, *Mgr. R. & D.* W. H. Huffman, *Ch. Chem.* J. W. Savage, *Pur. Agt.* W. J. Liechty, *Traf. Mgr.* Refinery located at Waterloo, Ark.

Berry, James B., Sons Co., Inc., Quaker State Bldg., Oil City, Pa.

James D. Berry, *Pres.* S. Messer, Frank Berry, E. L. Cleaves, *V. P.s.* W. R. Reitz, *Sec.* and *Treas.* G. B. Hunter, *Gen. Supt.* Lee R. Forker, *Pur. Agt.* Harry Shoemaker, *Supt.* Refinery located at Oil City, Pa.

Big West Oil Co. of Montana, 617 Hutton Bldg., Spokane, Wash.

L. R. Hawley, *Pres.* and *Gen. Mgr.* C. P. Lund, E. R. Northrop, *V. P.s.* John E. Orr, *Sec.* and *Treas.* G. A. Welch, *Sales Mgr.* G. A. Engle, *Gen. Supt. Ref.* and *Pur. Agt.* L. J. William, *Supt.* D. J. Mullady, *Ch. Chem.* and *Traf. Mgr.* Tom Pittman, *Ch. Engr.* Refinery located at Kevin, Mont.

Black Gold Refining Co., 604 Commerce Exchange Bldg., Oklahoma City, Okla.

R. G. Cocanower, *Sec., Treas.*, and *Gen. Mgr.* Refinery located at Oklahoma City, Okla.

Bradford Oil Refining Co., Box 197, Bradford, Pa.

J. Von Carlowitz, *V. P., Treas.* F. D. Korner, *V. P.* A. Pieritz, *Sales Mgr.* R. S. Bridier, *Ref. Supt.* J. N. Francis, *Ch. Chem.* Gervaise Flynn, *Ch. Engr.* W. F. Jewell, *Traf. Mgr.* Refinery located at Foster Brook, Bradford, Pa.

Bradford Penn Refining Corp., Clarendon, Pa.

Forest Dorn, *Pres.* A. D. David, *V. P.* Frank Miller, *Sec.* and *Treas., Gen. Mgr. Ref.* V. C. Burkard, *Gen. Supt. Ref.* W. A. Johnston, *Ch. Chem.* S. L. Myer, *Pur. Agt.* and *Traf. Mgr.* Refinery located at Clarendon, Pa.

Bridger Refinery, Box 317, Bridger, Mont.

Hershal F. Best, *Owner.* Plant at Bridger, Mont.

Bryson Pipe Line & Refining Co., Bryson, Tex.

George Kimbell, *Chm. Bd.* O. R. Tipps, *Pres.* Clyde Bohner, *V. P.* Yvonne Lenieux, *Sec.* Glenn Bear, *Treas.* Rex Young, *Gen. Mgr. Ref.* Clyde Hall Bryson, *Ref. Supt.* Knox Garvin, Jr., *Supt. Pipe Lines.* Refineries located at Bryson, Dallas, and Gainesville, Tex.

Bush, R. R., Oil Co., 2790 Cherry Ave., Long Beach, Calif.

R. R. Bush, *Pres.* W. H. Morgan, *V. P.* Neil Ensch, *Sec.* and *Treas.* W. E. Snowden, *Gen. Mgr. Ref.* G. N. Crowther, *Pur. Agt.* Refinery located at Long Beach, Calif.

C

California Oil & Refining Co., 2400 E. Artesia Blvd., North Long Beach, Calif.

W. J. Ross, *Pres.* Walter V. Stowell, *V. P.* Dr. Lewis H. Stanton, *Sec.* Elvin Lindblom, *Treas., Sales Mgr.*, and *Gen. Mgr. Ref.* Oscar Reeves, *Gen. Supt.* Elvin Lindblom and Oscar Reeves, *Purchases.* Refinery located at North Long Beach, Calif.

Calumet Refining Co., 4323 S. Western Blvd., Chicago, Ill.

Van S. Welch, *Pres.* T. A. Telfer, *V. P.* R. S. Watt, *Sec.* and *Treas.* Carl Harris, *Gen. Mgr. Ref.* R. F. Duncan, *Mgr. R. & D.* M. B. Jester, *Ch. Chem.* Refinery located at Burnham, Ill.

Caminol Co., Ltd., The, 112 W. Ninth St., Los Angeles, Calif.

C. B. Colby, *Pres.* and *Treas.* R. E. Hines, *V. P.* and *Gen. Mgr.* W. B. Allen, *Sec.* J. M. McElwain, *Sales Mgr.* Clifford Hancock, *Dir. Gasoline Sales.* D. H. Lewis, *Gen. Mgr. Ref.* M. V. Mueller, Santa Fe Springs; R. Mitchell, Hanford, *Supts.* Syd Garrett, *Ch. Chem.* R. W. McCament, *Pur. Agt.* Refineries located at Santa Fe Springs and Hanford, Calif.

Canfield Oil Co., The, 3216 E. 55th St., Cleveland, Ohio.

J. A. Jackson, *Pres.* H. M. Carruth, *V. P.* J. R. Nelson, *Sec.* A. L. Bailey, *Treas.* F. J. Van Bergen, *Asst. Sec.* Refineries located at Coraopolis, Pa., and Cleveland, Ohio.

Canton Refining Co., Box 350, Canton, Ohio.

W. E. Weidler, *Pres.* and *Treas.* M. R. Wiseman, *V. P.* R. S. Blazer, *Sec.* C. L. Wedell, *Gen. Supt. Ref.* R. K. Jones, W. B. Borst, *Asst. Supts.* Refinery located at Canton, Ohio.

Capitol Crude Oil Co. of Los Angeles, 1020 Subway Terminal Bldg., Los Angeles, Calif.

E. P. Clark, *Pres.* A. E. Smith, *Sec.* Refinery located at Ventura, Calif.

Carbide & Carbon Chemicals Corp., 30 E. Forty-second St., New York, N. Y.

J. A. Rafferty, *Pres.* C. O. Curme, Jr., J. G. Davidson, J. W. McLaughlin, H. E. Thompson, R. W. White, *V.P.s.* A. C. Cornell, *Sec.* P. F. Smith, *Treas.* W. F. Reich, Jr., *Sales Mgr.* G. B. Landes, *Works Mgr.* C. S. Heath, *Gen. Supt. Ref.* Refinery located at South Charleston, W. Va.

Caro Refineries, Inc., Caro, Mich.

D. W. Adams, *Pres.* D. C. Adams, *V. P.* Howard C. Clark, *Sec.* and *Treas.* K. M. Lindeman, *Sales Mgr* David Kennedy, *Gen. Mgr. Ref.* Refinery located at Caro, Mich.

Carpenter, Terry, Inc., Scottsbluff, Neb.

Terry Carpenter, *Pres.* Hazeldeane Carpenter, *V. P.* Martha Hillerege, *Sec.* and *Treas.* Don Hillerege, *Sales Mgr. Whlse.* Charles Glasby, *Gen. Mgr. Ref.* Joe Jinks, *Asst. Supt.* James Sutcliff, *Ch. Chem.* Clair Mercer, *Pur. Agt.* Refinery located at Scottsbluff, Neb.

Carroll, L. Ray, Roundup, Mont.

L. Ray Carroll, *Owner* and *Operator.* Plant located at Roundup, Mont.

Cascade Oil & Refining Co., Los Angeles, Calif.

Refineries located at Bandini, Torrance and Venice, Calif.

Cascade Refining Co., Centralia, Ill.

J. C. Potter, *Pres.* Refinery located at Centralia, Ill.

Rapid Transfer of Heat

AND FREEDOM FROM CORROSION ARE OBTAINED BY USING

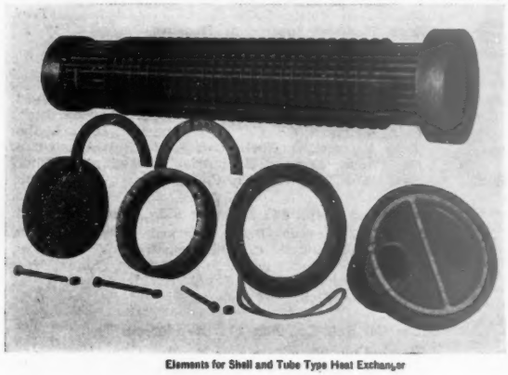
Karbate® NO. 2
TRADE-MARK
PIPE AND FITTINGS

FOR THE CONSTRUCTION OF HEATING OR COOLING COILS, EVAPORATORS AND OTHER HEAT EXCHANGE EQUIPMENT USED IN CONTACT WITH CORROSIVE MATERIALS

* "Karbate" is the trade-mark for a carbon or graphite base material impervious to seepage of fluids under pressure.

● "Karbate" No. 2 pipe has heat transfer properties equal to steel pipe of corresponding diameter. It is unaffected by salt water as well as most acids, alkalies and other corrosive materials.

Hundreds of heat exchangers of "Karbate" construction are in successful use. These represent many varied types, a few of which are illustrated on this page.


Elements for Shell and Tube Type Heat Exchanger

Return Bend Cooling Coil

National Carbon Company, Inc.
Cleveland, Ohio.

Gentlemen: Please send me information on the use of "Karbate," Carbon or Graphite materials for the application named.

APPLICATION CONSIDERED

NAME

FIRM

CITY STATE

OG

NATIONAL CARBON COMPANY, INC.
Unit of Union Carbide and Carbon Corporation
UCC

Carbon Sales Division: Cleveland, Ohio
GENERAL OFFICES
30 East 42nd Street, New York, N. Y.
BRANCH SALES OFFICES
New York, Pittsburgh, Chicago, St. Louis, San Francisco

Centralia Refining Co., 600 W. Seventh St., Centralia, Ill.

John J. Hassler, *Trustee,* Box 173, Mount Carmel, Ill. Refinery located at Centralia, Ill.

Central Illinois Oil & Ref. Co., Box 391, Centralia, Ill.

Paul L. Hale, Trustee in Bankruptcy. Refinery located at Centralia, Ill.

Century Oil Co., 1841 E. 29th St., Long Beach, Calif.

E. O. Bachmann, *Pres.* D. S. Jeppson, *V. P.* John G. Bachmann, *Sec.* and *Treas.* A. R. McIntosh, *Sales Mgr.* C. S. Cox, *Gen. Mgr. Ref.* Refinery located at Long Beach, Calif.

Chalmette Petroleum Corp., 1904 American Bank Bldg., New Orleans, La.

John Vaccaro, *Pres.* F. E. Holsten, *Exec. V. P.* L. E. Vivien, *Sec.* and *Treas.* H. LeGros, *Sales Mgr.* J. C. Senter, *Ref. Supt.* H. H. Long, *Asst. Supt.* Kohlman Campbell, *Ch. Chem.* V. G. McPherson, *Pur. Agt* Joseph A. Kearney, Jr., *Traf. Mgr.* Refinery located at Chalmette, La.

Champlin Refining Co., Enid, Okla.

H. H. Champlin, *Pres.* Joe N. Champlin, *V.P.* D. W. Cotton, *Sec.* and *Treas.* L. A. Snyder, *Sales Mgr. Whsle.* F. E. Kamp, *Sales Mgr. Retl.* E. J. Slater, Gen. *Supt. Ref.* L. E. Noble, *Pur. Agt.* W. J. Barnes, *Traf. Mgr.* Refinery located at Enid, Okla.

Chanute Refining Co., The, Box 431, Chanute, Kans.

R. A. Lind, *Pres.* and *Gen. Supt. Ref.* Elmer M. Cooper, *V. P.* Ray M. Coder, *Sec.* and *Treas.* J. M. Caldwell, *Ch. Chem.* Roscoe Young, *Ch. Engr.* Refinery located at Chanute, Kans.

C-H. Refinery, Lusk, Wyo.

James Mobbit, *Owner.* Refinery located at Lusk, Wyo.

Cities Service Oil Co. (Delaware), Bartlesville, Okla.

H. R. Straight, *Pres.* and *Gen. Mgr.* A. W. Ambrose, *V. P.* and *Asst. Gen. Mgr.* H. D. Frueauff, W. H. Merritt, C. E. Murray, *V. P.s.* C. E. Murray, *Sec.* L. A. Lynd, G. R. Preston, *Asst. Treas.* O. J. Tuttle, *Mgr. Ref. Sales.* C. A. Willis, *Mgr. Marketing Sales.* H. W. Camp, *Mgr. Ref.* L. D. Mann, *Gen. Supt. Ref.* W. W. Scheumann, *Ch. Chem.* Clay Briggs, *Ch. Engr.* Harris Bateman, *Pur. Agt.* A. C. Holmes, *Traff. Mgr.* L. N. Haugen, *Supt.* D. V. Eells, *Asst. Supt.* B. H. Mylius, R. S. Ross, E. F. Sonders, *Process Supts.,* Ponca City, Okla. E. H. Roy, *Ref. Supt.;* J. D. Snakenberg, *Asst. Supt.;* L. E. Taylor, J. A. Witherspoon, *Process Supts.,* East Chicago, Ind. C. O. Bailey, *Ref. Supt.,* Okmulgee, Okla. Refineries located at Ponca City and Okmulgee, Okla., and East Chicago, Ind.

Cities Service Oil Co. (Pennsylvania), 70 Pine St., New York, N. Y.

T. W. Tutwiler, *Pres.* J. S. Cordell, *V.P.* and *Gen. Mgr.* H. D. Frueauff, C. E. Foster, H. E. Brandli, C. Story, W. W. McFarland, *V.P.s.* E. N. Watkins, *Sec.* W. W. Martin, *Treas.* J. A. Kelley, *Sales Mgr.* L. M. Bound, *Gen. Supt. Ref.* J. W. Griswold, *Mgr. R. & D.* T. G. Gray, *Ch. Chem.* C. T. Stanhope, *Ch. Engr. Ref. Dept.* C. R. Jackson, *Ch. Marketing Dept.* E. D. Erney, *Pur. Agt.* W. A. Hamel, *Traf. Mgr.* E. M. Keely, *Supt.;* L. A. Besselman, *Asst. Supt.* Petty's Island. H. O. Davis, *Supt.;* P. I. Tinkler, *Asst. Supt.,* Warners. D. P. Sturgis, *Supt.;* H. M. Harmon, *Asst. Supt.,* Braintree. C. E. Kinder, *Supt.;* A. F. Anderson, *Asst. Supt.,* Titusville. Refineries located at East Braintree, Mass.; Titusville, Pa.; Linden (Warners), N. J.; Philadelphia (Petty's Island), Pa.

Coastal Petroleum Corp., Mobile, Ala.

John T. Cochrane, Jr., *Pres.* George S. Cochrane, *V. P.* E. D. Shaffer, *Sec.* and *Treas.* R. K. Owen, *Ref. Supt.* Refinery located at Mobile, Ala.

Coastal Refineries, Inc., Taylor, Tex.

G. L. Rowsey, *Pres.* T. F. Murchison *V. P.* Harris A. Melasky, *Sec.* and *Treas.* Dorothy V. West, *Asst. Sec.* W. R. Arrington, *Asst. Treas.* Neil Buckley, *Sales Mgr.* James L. Sewell, *Gen. Supt. Ref.* S. A. Coleman, Jr., Port Isabel, *Supt.* F. L. Marlin, *Ch. Chem.* Refinery located at Port Isabel, Tex.

Coleman Refining Corp., Box 330, Abilene, Tex.

O. B. Stephens, *Chm. Bd.* Ray McGlothlin, *Pres.* and *Gen. Mgr.* C. I. Powell, *V. P.* M. C. Drummond, *Asst. Supt.* Refinery located at Coleman, Tex.

Colonial Beacon Oil Co., 30 Beacham St., Everett, Mass.

A. Clarke Bedford, *Pres.* J. C. Richdale, *V. P.* and *Sales Mgr. (New England).* D. M. Cox, *V. P.* and *Sales Mgr. (New York).* L. E. Ulrope, *V. P.* A. F. Whiting, *Sec.* and *Treas.* P. C. Shea, *Gen. Mgr. Ref.* William Naden, *Gen. Supt.* J. F. Lyons, *Process Supt.* C. H. Cole, *Tech. Asst. to Gen. Mgr.* J. D. Lawler, *Ch. Chem.* H. L. Bolton, *Ch. Engr.* George E. Clarke, *Pur. Agt.* Refinery located at Everett, Mass.

Col-Tex Refining Co., 1000 Ramsey Tower, Oklahoma City, Okla.

L. H. Prichard, *Pres.* J. Steve Anderson, *V. P.* P. H. Anderson, *Sec.* and *Treas.* C. L. Mayhall, *Sales Mgr. Refined Oils.* C. H. Dresser, *Sales Mgr. Asphalts.* George H. Burruss, *Gen. Mgr. Ref.* Neal Prichard, Colorado City, *Ref. Supt.* B. I. Scoggin, Jr., *Mgr. R. & D.* C. A. Prichard, *Pur. Agt.* Refinery located at Colorado City, Tex.

Comet Oil Co., Ltd., 2930 Cherry Ave., Long Beach, Calif.

W. P. Andrews and Fred C. Davies, *Partners.* Fred C. Davies, *Sales Mgr.* W. P. Andrews, *Gen. Mgr. Ref.* A. K. Miller, *Gen. Supt. Ref.* Refinery located at Long Beach, Calif.

Conewango Refining Co., Warren, Pa.

Harry R. Lewis, *Pres.* I. J. Bergholt, *V. P.* J. von Bevern, *Sec.* C. A. Christensen, *Treas.* Refinery located at Warren, Pa. (Management of company taken over by Sinclair Refining Co.).

Consumers Oil & Refining Co., Newcastle, Wyo.

P. N. Fortin, *Pres.* G. L. Culver, *V. P., Treas.* and *Gen. Mgr. Ref.* L. B. Hancock, *Sec.* H. G. Martens, *Gen. Supt. Ref.* Refinery located at Newcastle, Wyo.

Continental Oil Co., Ponca City, Okla.

Dan Moran, *Pres.* G. F. Smith, *V. P.* and *Treas.* Walter Miller, *V. P. Mfg.* Harry J. Kennedy, *V. P. chg. Sales.* W. W. Bruce, R. E. Collom, J. G. Dyer, *V. P.s.* James J. Cosgrove, *Sec.* Harold G. Osborn, *Mgr. Mfg.* L. L. Davis, *Supervisor Process Div.* B. H. Lincoln, *Ch. Chem.* M. E Clawson, *Ch. Engr.* G. W. Evans, *Pur. Agt.* P. H. Kuhns, *Traf. Mgr.* Fred G. Fellows, *Supt.;* J. O. Thoen, *Asst. Supt.,* Ponca City. J. W. Brown, *Supt.;* J. M. Jones, *Asst. Supt.,* Baltimore. J. E. Fenex, *Supt.;* W. M. Cocke, *Asst. Supt.,* Lake Charles, D. H. Hyler, *Supt.;* J. A. Ramsey, *Asst. Supt.,* Wichita Falls. R. H. Main, *Supt.;* H. H. Kinnaird, *Asst. Supt.,* Glenrock. James P. Markey, Farmington; Charles Morgan, Artesia; L. L. Smith, Denver; J. A. Mann, Lewistown; Fred S. Nesmith, Riverside, *Supts.* Refineries located at Ponca City Okla.; Baltimore, Md.; Lake Charles (West Lake), La.; Wichita Falls, Tex.; Glenrock, Wyo.; Farmington, N. M.; Artesia, N. M.; Denver, Colo.; Lewistown, Mont.

Continental Refining Co., Box 175, Oil City, Pa.

T. A. Anderton, *Pres.* M. A. DeArman, *V. P.* S. S. DeArman, *Sec.* J. W. Anderton, *Treas.* C. H. Thomas, *Sales Mgr.* W. J. Anderton, *Gen. Mgr. Ref.* E. F.

MARSH

YOU can't buy a gauge that's stronger or more accurate than the Marsh "Mastergauge". Add to this the exclusive Marsh "Recalibrator"—which provides a simple, quick way to keep the gauge accurate throughout its *entire* scale—and you have every reason for standardizing on the "oil industry's OWN gauge".

Styles and sizes for all services

JAS. P. MARSH CORPORATION
2065 Southport Avenue, Chicago, Illinois

GAUGES

Hanna, *Gen. Supt.* E. T. Anderton, *Ch. Chem.* J. C. Vogan, *Ch. Engr.* H. Wiley, *Pur. Agt.* D. C. Hasson, *Traf. Mgr.* Refinery located at Oil City, Pa.

Cooperative Refinery Association, North Kansas City, Mo.

Howard A. Cowden, *Pres.* and *Gen. Mgr. Ref.* T. H. DeWitt, *V. P.* Clifford Miller, *Sec.* and *Treas.* Homer Young, *Sales Mgr. Whsle.* Bruce McCully, *Sales Mgr. Retl.* L. M. Johnston, *Gen. Supt. Ref.* Miles Cowden, *Asst. Supt.* William Helberg, *Ch. Chem.* Vernon Lintner, *Pur. Agt.* N. A. Ormsby, *Traf. Mgr.* Refinery located at Phillipsburg, Kans.

Cosco Oil Co., Wynnewood, Okla.

J. S. Cosden, Jr., *V. P.* and *Sales Mgr.* E. G. Davenport, *Sec.* Joe C. Ernest, *Gen. Supt. Ref.* and *Pur. Agt.* Maloy Stevenson, *Asst. Supt.* Mason Dixon, *Ch. Chem.* Maloy Stevenson, *Ch. Engr.* L. F. Allmendinger, *Traf. Mgr.* Refinery located at Wynnewood, Okla.

Cosden Petroleum Corp., Box 1311, Big Spring, Tex.

R. L. Tollett, *Pres.* and *Gen. Mgr.* M. C. Zaidenberg, *V. P.* A. V. Karcher, *Sec.* and *Treas.* W. E. Gibson, *Sales Mgr.* J. L. Le Bleu, Big Spring; George Grimes, Graham, *Supts.* Ray Lawrence, *Still Foreman.* E. W. Richardson, *Treating Supt.* J. B. Mull, *Mgr. R. & D.* Harold F. Bottomley, *Ch. Chem.* Harry A. Brown, *Ch. Engr.* Otto Peters, *Pur. Agt.* D. L. Orme, *Traf. Mgr.* Refineries located at Big Spring and Graham, Tex.

Crook County Refinery, Sundance, Wyo.

A. Policky, *Sales Mgr. Whsle.* and *Pur. Agt.* Frank Policky, *Sales Mgr. Retl.* Ralph Watson, *Gen. Mgr. Ref.* Joe Policky, *Gen. Supt. Ref.* Refinery located at Sundance, Wyo.

Cross, Henry H., Co., 122 S. Michigan Ave., Chicago, Ill.

George F. Fox, *Pres.* O. B. Bingham, Smackover, *Mgr.* N. R. Price, Smackover; D. L. Crandall, Colmar; J. L. McAndrew, Dupo, *Ref. Supts.* Refineries located at Smackover, Ark.; Colmar, Ill; Dupo, Ill.

Crown Central Petroleum Corp., American Bldg., Baltimore, Md.

Henry A. Rosenberg, *Pres.* H. S. Lane, *V. P.* James T. B. Bowles, *Sec.* S. K. Waters, *Treas.* Jesse Stickel, *Sales Mgr.* K. W. Shimeall, *Gen. Mgr. Ref.* R. S. Myers, *Ref. Supt.* N. L. Cort, *Pur. Agt.* F. C. Clark, *Traf. Mgr.* Refinery located at Houston, Tex.

Crystal Refining Co. of Carson City, Inc., Carson City, Mich.

G. Fred Pratt, *Pres.* E. G. Guy, *V. P.* and *Gen. Mgr.* J. G. Fleckenstein, *V. P. chg. Sales.* M. A. Hagerman, *Sec.* and *Treas.* C. B. Johnson, *Gen. Supt. Ref.* William I. Chamberlin, *Ch. Chem.* Robert Hallett, *Elec. Ch. Engr.* M. A. Hagerman, *Pur. Agt.* E. G. Geller, *Traf. Mgr.* Refinery located at Carson City, Mich.

Cushing Refining & Gasoline Co., Box 1111, Cushing, Okla.

R. C. Jones, *Pres.* Rex H. Winget, *V. P., Gen. Mgr.* and *Pur. Agt.* Max E. James, *Sec.* and *Treas.* E. O. Derrick, *Sales Mgr.* J. H. Hutchinson, *Gen. Supt.* H. A. Booher, *Ref. Supt.* Theron B. Randall, *Ch. Chem.* Refinery located at Cushing, Okla.

Cut Bank Refining Co., Cut Bank, Mont.

Kenneth H. Davis, *Pres.* R. C. Tarrant, *V. P.* James W. Price, *Sec.* Ray Searson, *Sales Mgr.* H. A. Lynn, *Gen. Supt. Ref.* Refinery located at Cut Bank, Mont.

D

Danciger Oil & Refineries, Inc., Hunt Bldg., Tulsa, Okla.

Dan Danciger, *Pres.* A. Danciger, *V. P.* and *Asst. Treas.* Joe Danciger, Jack Danciger, *V. P.s.* J. E. Vaeth, *Sec.* Leo R. Brammer, *Sales Mgr.* G. E. Dahlen, *Auditor.* Fred E. Shryock, *Supt.;* Loy E. Keck, *Asst. Supt.,* Pampa. Morris Levine, *Mgr. R. & D.* Lysle W. Owen, *Ch. Chem.* Jay Hausam, *Pur. Agt.* E. W. Johnson, *Traf. Mgr.* Refinery located at Pampa, Tex.

Danube Oil Corp., 222 Amarillo Bldg., Amarillo, Tex.

Rip C. Underwood, *Pres.* C. M. Humphrys, *V. P.* Roy E. Lantz, *Sec.* and *Treas.* N. E. Schneider *Sales Mgr.* and *Gen. Mgr. Ref.* E. C. Livingston, *Supt. Ref.* E. L. Wilson, *Ch. Chem.* Refinery located at Borger, Tex.

Davis Oil Co., Newcastle, Wyo.

Refinery located at Newcastle, Wyo.

Daugherty Refinery, a Division of I. Sonneborn Sons, Inc., 88 Lexington Ave., New York, N. Y.

Dr. F. Sonneborn, *Pres.* J. F. Roten, *V. P.* R. G. Sonneborn, *Sec.* Max Pick, *Treas.* T. M. Murphy, *Mgr.* D. A. Schoerke, *Ch. Engr.* Dr. F. W. Breth, *Ch. Chem.* C. E. McGinnis, *Supt.* Refinery located at Petrolia, Pa.

Deep Rock Oil Corp., Atlas Life Bldg., Tulsa, Okla.

B. L. Majewski, *Sales Mgr.* H. R. Gillespie, *Traf. Mgr.,* Chicago. W. E. Moody, *Gen. Mgr. Ref.;* George Waltershausen, *Gen. Supt.;* B. C. Frichot, *Ch. Chem.;* R. B. Davis, *Ch. Engr.,* Cushing. R. G. Martin, Tulsa, *Pur. Agt.* Refinery located at Cushing, Okla.

Deloraine Refining Co., Box F, Oilmont, Mont.

Henry Vander Pas, *Pres.* O. A. Nepstad, *V. P.* Garth Wheeler, *Sec.* J. L. Peyton, *Sales Mgr., Gen. Mgr. Ref.,* and *Pur. Agt.* P. O. Engen, *Gen. Supt.* and *Ch. Chem.* Refinery located at Oilmont, Mont.

Delta Refining Co., Sullivan City, Tex.

W. C. Witt, Dallas, Tex., *Pres.* Ed Sullivan, *V. P.* H. R. Hodge, *Gen. Supt.* Refinery located at Sullivan City, Tex.

Derby Oil Co., The, 352 N. Broadway, Wichita, Kans.

A. L. Derby, *Chm. Bd.* Carl Fisher, *Pres.* H. E. Zoller, *Exec. V. P.* and *Gen. Mgr.* F. W. McCurry, *V. P. chg. Mfg.* S. P. Wallingford, *V. P.* E. Wasser, *Sec.* E. C. Claiborne, *Treas.* C. A. Keller, *Sales Mgr. Whsle.* H. S. Dickson. *Sales Mgr. Retl.* E. R. Jones, *Ref. Supt.* George Weber, *Asst. Supt.* Sam Tihen, *Ch. Chem.* Guy Proctor, *Pur. Agt.* H. W. Watts, *Traf. Mgr.* Refinery located at Wichita, Kans.

Diamond Oil Co., 414 Beneficial Life Bldg., Salt Lake City, Utah.

John Shewell, *Pres.* C. S. Martin, *V. P.* A. Hill, *Sec.* Refinery located at Virgin, Utah. (Leased to Baker Petroleum Corp.).

Douglas Oil & Refining Co., Wilmington, Calif.

Donald Douglas, *Chm. Bd.* George W. Strattan, *Pres.* William P. Andrews, *V. P.* A. L. Bergere, *Sec.* and *Treas.* Fred C. Davies, *Sales Mgr.* D. C. Moore, *Comptroller.* Refinery located at Wilmington, Calif.

Douglas Refinery, Box 142, Douglas, Wyo.

G. W. Detrick, *Owner.* Plant located at Douglas, Wyo.

E

Eagle Oil & Refining Co., Inc., Santa Fe Springs, Calif.

Frans Nelson, *Chm. Bd.* H. T. Nelson, *Pres.* J. D. Sterling, Frank Hane, *V.P.s.* Ralph Jones, *Sec.* and *Treas.* J. D. Sterling, *Sales Mgr.* Will Burrows, *Gen. Supt. Ref.* Harry Trombly, *Asst. Supt.* Refinery located at Santa Fe Springs, Calif.

Recondition those Pitted Sections
under ALL weather conditions

Cold, Hand-Applied NO-OX-ID Gives Lasting Pipe-Line Protection

You don't have to go to great expense to recondition sections of your pipe where "hot spots" have caused bad pitting and corrosion. NO-OX-ID cold, hand-applied coatings are easy and inexpensive to apply and give positive protection.

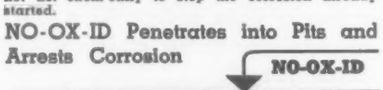
NO-OX-ID is particularly adapted for reconditioning work. At a minimum of coating expense, it will stop pitting that has already started and prevent future corrosion. Its application is possible under practically all weather conditions. NO-OX-ID coatings are used extensively in swampy and wet areas which are inaccessible to other methods of coating. They are especially suitable for small repair jobs and replacement of short sections of line where it is not desirable to carry extensive equipment.

Dearborn Chemical Company
Dept. K, 310 S. Michigan Ave., Chicago

Most Coatings "Bridge" the Pits and Corrosion Continues

Ordinary hot coats do not penetrate into the pitted areas on pipe that is being reconditioned. Instead, they "bridge" over the pits. Furthermore, they do not act chemically to stop the corrosion already started.

NO-OX-ID Penetrates into Pits and Arrests Corrosion



NO-OX-ID is really forced into all pits and rusted areas. The chemical inhibitors in NO-OX-ID immediately check all active corrosion. Application can be made under all weather conditions without extensive equipment.

NO-OX-ID
IRON + OX = RUST
The Original Rust Preventive

RUST PREVENTIVE PIPE COATINGS

DEARBORN CHEMICAL COMPANY
NO-OX-ID IZED WRAPPER
NEW YORK — CHICAGO

Eason Oil Co., Enid, Okla.
T. T. Eason, *Pres.* L. D. Hinman, *V. P.* T. W. Eason, *Sec.* and *Treas.* R. H. Rowland, *Whlse. Sales Mgr.* A. C. Hatton, *Retl. Sales Mgr.* and *Pur. Agt.* P. G. Maranville, *Gen. Mgr. Ref.* P. G. Lyons, *Ch. Chem.* Refinery located at Enid, Okla.

Eastern States Petroleum Co., Inc., 617 Caroline St., Houston, Tex.
R. B. Kahle, *Pres.* L. J. Walsh, J. F. McCarthy, *V. P.s.* B. F. Fallon, *V. P.* and *Sec.* G. I. Lewis *Treas.* H. F. Schreiber, *Sales Mgr. Whsle.* L. A Wilkening, *Sales Mgr. Retl.* R. Q. Traweek, *Gen. Supt. Ref.* P. A. Kahle, Jr., *Asst. Supt.* J. G. Boyles. *Process Supt.* E. W. Patterson, *Ch. Chem.* Ike Hilmers, *Ch. Engr.* J. J. Fallon, *Pur. Agt.* L. W. Smith, *Traf. Mgr.* Refinery located at Houston, Tex.

East Texas Refining Co. (Subsidiary of Skelly Oil Co.), Tower Petroleum Bldg., Dallas, Tex.
W. G. Skelly, *Pres.;* C. C. Herndon, *Exec. V. P.;* F. T. Hopp, *Sec.* and *Treas.*, Tulsa. L. F. Brothers, *V. P.* John R. Scott, *Asst. Sec.* and *Treas.*, Dallas. John J. Thomas, Longview, *Ref. Supt.* Refinery located at Longview, Tex.

East West Refining Co., 1815 S. Soto St., Los Angeles, Calif.
Benard F. Alfs, *Pres.* R. W. Norton, *V. P.* Refinery located at Los Angeles, Calif.

Egyptian Producing & Refining Co., Box 341, Centralia, Ill.
Perry T. Fess, *Pres.* L. L. Urquhart, *Sec., Treas.* and *Gen. Mgr.* Vincent J. Nolan, *Sales Mgr.* Refinery located at Centralia, Ill.

El Camino Refining Co., 811 W. Seventh St., Los Angeles, Calif.
H. A. Meek, *Pres.* J. Vernon Pohl, *V. P.* and *Whlse. Sales Mgr.* Earl Glen Whitehead, *Sec.* B. E. Devere, *Treas.* D. F. Wallace, *Retl. Sales Mgr.* L. Daams, *Gen. Mgr. Ref.* and *Pur. Agt.* Wayne Morris, *Gen. Supt.* Glenn Coiner, *Traf. Mgr.* Refinery located at Los Alamitos, Calif.

El Dorado Refining Co., The, El Dorado, Kans.
Charles G. Yankey, *Pres.* Robert H. Bradford, *V. P.* and *Treas.* T. A. Helling, *V. P.* and *Gen. Mgr.* George J. Peterschmidt, *Sec.* C. W. Rice, *Sales Mgr. Whlse.* C. A. Elmborg, *Sales Mgr. Retl.* G. C. Anderson, *Ref. Supt.* H. J. Datin, *Asst. Supt.* C. M. Boone, *Ch. Chem.* O. G. Jackson, *Pur. Agt.* R. E. Fisher, *Traf. Mgr.* Refinery located at El Dorado, Kans.

Elk Horn Gas Refinery, Osage, Wyo.
Joseph F. Dornocher, *Owner.* Plant located at Osage, Wyo.

Elk Refining Co., Kanawha Valley Bldg., Charleston, W. Va.
H. A. Logan, *Pres.* F. G. Bannerot, *V. P.* and *Treas.* F. G. Bannerot, Jr., *V. P.* and *Sec.* R. D. Lowe, *Sales Mgr. Whlse.* J. W. Wright, *Sales Mgr. Retl.* Robert Burr, *Ref. Supt.* C. J. Hesch, C. E. Kirk, *Asst. Supts.* F. A. Nicholson, *Ch. Chem.* L. K. Forthman, *Pur. Agt.* C. V. Harner, *Traf. Mgr.* and finery located at Falling Rock, W. Va.

Elm Oil Co., 3328 Elm Ave., Long Beach, Calif.
J. A. Novelli, *Sales Mgr.* Fred Steiner, *Gen. Mgr. Ref.* Refinery located at Long Beach, Calif.

El Tejon Oil & Refining Corp., Box 546, Bakersfield, Calif.
Gould M. Fitch, *Pres.* Walter J. Meyers, *V. P.* and *Sales Mgr. Whlse.* George W. Gill, Jr., *Sec.* and *Treas.* George W. Buchanan, *Sales Mgr. Retl.* Joe D. Weedon, *Gen. Supt. Ref.* George W. Gill, Jr., *Process Supt.* Byron G. Adams, *Ch. Chem.* Refinery located at Mountain View, Calif.

Empire State Oil Co., Thermopolis, Wyo.
H. D. Curtis, *Chm. Bd.* and *Pres.* H. H. Schwartz, *V. P.* F. C. Myles, *Sec.* Fred H. Curtis, *Treas.* Charles Nix, *Sales Mgr.* John S. Herrin, *Gen. Mgr. Ref.* and *Ch. Engr.* J. E. Simon, *Ch. Chem.* Refinery located at Thermopolis, Wyo.

Envoy Petroleum Co., 3000 Walnut Ave., Long Beach, Calif.
A. M. Lockhart, *Pres.* and *Treas.* J. I. Witz, *V. P.* W. S. Wilsey, *Sec.* and *Pur. Agt.* Louis G. Francis, *Sales Mgr.* Refinery located at Long Beach, Calif.

Equity Oil Co., 901 Utah Oil Bldg., Salt Lake City, Utah.
J. L. Dougan, *Pres.* and *Mgr.* A. E. Tourssen, *V. P.* L. Joseph Wise, *Sec.* and *Treas.* D. D. Gibson, *Gen. Supt.* Refinery located at Vernal (Jensen), Utah.

Essex Refining Co., 1012 Saginaw St., Bay City, Mich.
E. E. Brehm, *Pres.* and *Sales Mgr.* William Kerr, *V. P.* G. C. Weiler, *Sec.* and *Treas.* Harry Calopy, *Ref. Supt.* S. E. Johnson, *Ch. Chem.* Refinery located at Bay City, Mich.

Estado Petroleum Corp., 1358 E. 23rd St., Long Beach, Calif.
L. Y. Mattes, *Pres.* and *Gen. Mgr.* H. Hartsock, *Sec.* and *Treas.* E. E. Greiner, *Gen. Supt.* W. B. McColm, *Ch. Chem.* Refinery located at Long Beach, Calif.

Evangeline Refining Co., Jennings, La.
B. V. Todd, *Sales Mgr.* W. J. McBurney, *Gen. Mgr.* Refinery located at Jennings, La.

Evansville Oil Corp., 613 Giddens Lane Bldg., Shreveport, La.
J. P. Evans, *Pres.* Jack Coast, *V. P.* Byrd Hamilton, *Sec.* and *Treas.* Claude Burson, *Ref. Supt.* R. B. Swain, *Ch. Chem.* Refinery located at Cotton Valley, La.

Evansville Refining Co., Evansville, Ind.
P. H. Hertzog, *Pres.* Refinery located at Evansville, Ind.

Exeter Refining Co., P. O. Box 5007, Long Beach, Calif.
Carl von Bibra, *Pres.* Earle F. Demond, *V. P.* and *Treas.* Harold E. Thomas, *Sec.* L. A. Donnelly, *Mgr. Marine Sales.* N. F. Gallucci, *Mgr. Ref.* and *Pur. Agt.* J. J. Klein, *Ch. Chem.* E. L. Patterson, *Traf. Mgr.* Refinery located at Long Beach, Calif.

F

Fairfield Refining Corp., Drawer 71, Fairfield, Ill.
J. S. Schurman, *Pres.* R. N. McNeilly, *V. P.* A. H. Eisler, *Sec.* and *Treas.* G. H. Stierwalt, *Sales Mgr.* R. B. Knight, *Gen. Mgr. Ref.* and *Pur. Agt.* N. Balai, *Ch. Chem.* Refinery located at Fairfield, Ill.

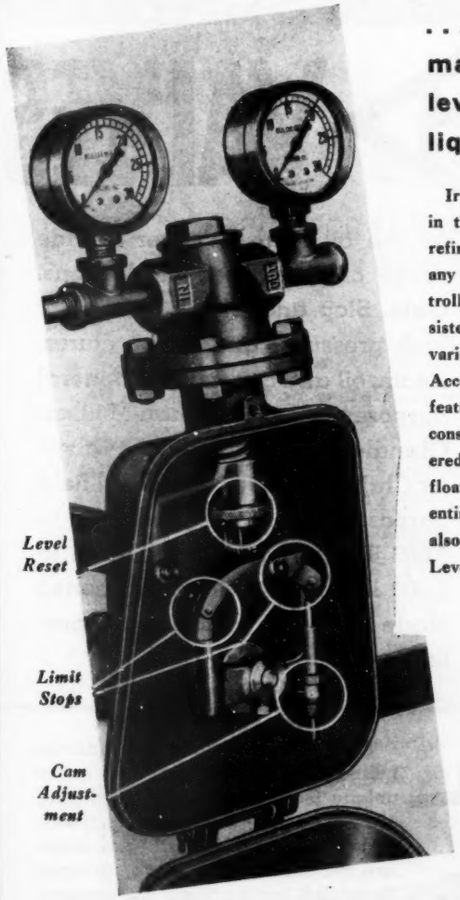
Falcon Refining Co., The, Great Bend, Kans.
Henry Dickason, *Pres.* B. W. Morris, *V. P.* R. W. Morris, *Sec.* and *Treas.* Eldon Wallace, *Sales Mgr.* R. W. Russell, *Gen. Mgr. Ref.* O. H. Weidle, *Ref. Supt.* C. L. Wise, *Ch. Chem.* O. H. Shafer, *Pur. Agt.* N. K. Philips, *Mgr. R.R. Traf.* M. M. Knush, *Mgr. Truck Traf.* Refinery located at Great Bend, Kans.

Falls Ref. Co., Inc., Box 241, Henderson, Tex.
T. P. Cannon, *Pres., Treas.,* and *Gen. Mgr. Ref.* Mrs. A. M. Roberts, Dallas, Tex., *V. P.* T. A. Garnett, *Sec.* Walter Raymer, Wichita Falls, Tex., *Gen. Sales Mgr.* and *Supt.* Refinery located at Wichita Falls, Tex.

Field, O. C., Gasoline Corp., 944 Wilshire Blvd., Los Angeles, Calif.
R. B. Hale, *Chm. Bd.* O. C. Field, *Pres.* W. G. Met-

McALEAR

Liquid Level Control PILOT



. . . affords greater accuracy in maintaining a definite liquid level or a definite variation of liquid level.

Irregularities in flow cease to be disturbing factors in the operation of air-regulated control systems in refineries. The McAlear No. 95 Pilot, mounted on any one of the several McAlear Float Cage type Controllers or Internal Float Type Controllers, will consistently maintain a definite liquid level or a definite variation of liquid level regardless of flow conditions. Accuracy and range of control are chief among its features; by a simple adjustment of a thumb nut a constant delivered air pressure—or any range of delivered air pressure—may be had for either the smallest float movement or for a float movement over the entire mechanical limits of the controller. This Pilot also is readily adapted to other makes of Liquid Level Controllers.

McALEAR No. 99 PRESSURE CONTROL PILOT——→

This pilot is another recent development by McAlear to insure extremely close control of pressures—control as close as ±2%—when used in conjunction with a McAlear or any other make of Diaphragm Motor Valve. Fully adjustable for maintaining constant pressures, and by a simple throttling range adjustment, the swinging or hunting of the control valve can be eliminated. Made for any desired working pressures.

Write for Complete Details

McALEAR MFG. CO.
1901-1907 S. Western Ave.,
CHICAGO, ILL.
Sales Engineers in Principal Cities

son, J. C. Burks, *V. P.s.* Newton J. Hale, *Sec.* and *Treas.* George E. Acheson, *Sales Mgr.* A. C. Young, *Ref. Supt.* Refinery located at Casmalia, Calif.

Five C Refining Co., 1219 Transamerica Bldg., Los Angeles, Calif.

G. H. Cherry, *Pres.* John G. Cherry, *V. P.* Guy H. Cherry, Jr., *Sec.* and *Treas.* H. G. Phillips, *Sales Mgr.* Guy H. Cherry, Jr., *Gen. Mgr. Ref.* D. M. Prentice, *Gen. Supt. Ref.* Walter Steavenson, *Ch. Chem.* Marvin Tognazzine, *Traf. Mgr.* Refinery located at Santa Maria, Calif.

Fletcher Oil Co., Inc., 530 West Sixth St., Los Angeles, Calif.

D. S. Fletcher, *Pres.* F. O. Fletcher, *V. P.* A. R. Hudgins, *Sec.* and *Treas.* O. H. Muller, *Sales Mgr.* John F. Lynch, *Gen. Supt. Ref.* L. A. Hulsey, J. O. Wonder, *Ch. Chem.* Refinery located at Wilmington, Calif.

Fort Dale Oil & Refining Co., Bloomingdale, Mich.

Rae W. Lewis, *Pres.* Fred A. Carlson, *V. P.* A. B. Wiggins, *Sec.* and *Treas.* Max J. Lewis, *Sales Mgr.* H. B. Crell, *Gen. Supt. Ref.* L. N. Gilbert, *Asst. Supt.* Refinery located at Bloomingdale, Mich.

Franklin Creek Refining Corp., 88 Lexington Ave., New York, N. Y.

Dr. Ferdinand Sonneborn, *Pres.* J. F. Roten, *V. P.* D. G. Sonneborn, *Sec.* M. Pick, *Treas.* C. H. Alsberg, *Gen. Supt.* C. F. Felton, *Sales Mgr.* T. G. Murphy, *Ch. Chem.* Refinery located at Franklin, Pa.

Freedom Oil Co., Freedom, Pa.

Earle M. Craig, *Pres.* and *Treas.* Wm. G. Bechman, *V.P.* and *Sec.* R. B. McKee, *V.P.* and *Sales Mgr. Whsle.* E. N. McDonald, *Sales Mgr. Retl.* B. L. Heath, *Gen. Supt. Ref.* Gerald W. Wallace, *Ch. Chem.* George J. Mohr, *Pur. Agt.* H. L. Wissner, *Traf. Mgr.* Refinery located at Freedom, Pa.

Frontier Fuel Oil Corp., 986 Elliott Square, Buffalo, N. Y.

J. F. Brevil, *Pres.* C. H. Lathrop, *V. P.* W. H. Bennett, *Sec.* and *Treas.* M. C. Sumpter, *Gen. Supt. Ref.* W. Maier, *Pur. Agt.* F. F. Ott, *Traf. Mgr.* Refinery located at Buffalo, N. Y.

Frontier Refining Co., The, 807 First Natl. Bank Bldg., Denver, Colo.

M. H. Robineau, *Pres.* and *Sales Mgr.* A. R. Kline, *V.P.* H. E. Armitage, *Sec., Treas.* and *Pur. Agt.* R. R. Rankin, *Gen. Supt.* Jay Olvey, *Ch. Chem.* Refinery located at Cheyenne, Wyo.

G

Gallatin Valley Co-Operative Co., Belgrade, Mont.

Noble Estes, *Gen. Mgr.* Refinery located at Belgrade, Mont.

Gallup City Refinery, Conrad, Mont.

Ted Hawley, *Owner* and *operator.* Plant located at Conrad, Mont.

Gem State Refining Co., Twin Falls, Idaho.

Refinery located at Twin Falls, Idaho.

General Oil Corp., Box 505, New Orleans, La.

F. R. Sylvestre, *Chm. Bd.* Robert H. Beattie, *Pres.* and *Gen. Mgr. Ref.* Peter J. Ruman, *V.P.* and *Pur. Agt.* Dale Beattie, *Sec.* C. P. Christman, *Gen. Supt.* George H. Oertel, *Ch. Chem.* George A. Arbo, *Traf. Mgr.* Refinery located at Meraux, La.

General Petroleum Corp. of California, 108 W. Second St., Los Angeles, Calif.

S. J. Dickey, *Pres.* R. A. Sperry, B. E. Parsons, E. L. Adams, *V. P.s.* A. H. DeFriest, *V. P. and Dir. of Marketing.* D. W. Woods, *Sec.* W. Cunningham, *Treas.* Don Dawson, *Gen. Sales Mgr.* Fred Isaacs, *Mgr. Refineries.* R. C. Wheeler, *Mgr. Gas Dept.* G. F. Olsen, *Mgr. Laboratories.* V. F. Grace, *Mgr. Engr. Dept.* E. W. Beck, *Pur. Agt.* C. E. Ziegler, *Traf. Mgr.* Refineries located at Torrance, Vernon, and Lebec, Calif.

General Refining Co., Box 234, Grand Haven, Mich.

C. H. Louree, *Pres.* H. J. Dillon, *V. P.* John Ezinga, *Sec.* and *Treas.* J. B. Ryan, *Sales* and *Gen. Mgr.* Harry Banks, *Ref. Supt.* and *Pur. Agt.* Ralph Black, *Ch. Engr.* A. A. Johnson, *Traf. Mgr.* Refinery located at Grand Haven, Mich.

Glacier Production Co., 40 E. Broadway, Butte, Mont.

F. W. Bird, *Pres.* S. P. Hogan, *Sec.* J. R. Thomas, *Treas.* C. D. Warner, *Sales Mgr.* R. D. Smith, *Gen. Mgr. Ref.* E. M. Parkin, *Ref. Supt.* Dean Humphries, *Ch. Chem.* H. H. Cochrane, *Ch. Engr.* W. T. Jackson, *Pur. Agt.* Refinery located at Cut Bank, Mont.

Gladewater Refining Co., Box 716, Gladewater, Tex.

L. Schnyder, *Sales Mgr.* H. F. Richardson, *Gen. Mgr.* and *Pur. Agt.* W. F. Thomas, *Gen. Supt.* A. L. Miles, *Ch. Chem.* Refinery located at Gladewater, Tex.

Globe Oil & Refining Co., The, (Illinois), Globe Bldg., Wichita, Kans.

I. A. O'Shaughnessy, *Pres.* F. L. Jehle, *V.P.* and *Gen. Mgr. Ref.* G. G. Woodruff, *Sec., Treas.* and *Sales Mgr.* H. B. Overton, *Ref. Supt.* W. F. Krause, *Ch. Chem.* R. A. Fox, *Ch. Engr.* E. R. Walcher, *Traf. Mgr.* Refinery located at Lemont, Ill.

Globe Oil & Refining Co., The, (Kansas), Globe Bldg., Wichita, Kans.

I. A. O'Shaughnessy, *Pres.* F. L. Jehle, *V.P.* and *Gen. Mgr. Ref.* J. F. O'Shaughnessy, *Sec.* and *Treas.* A. E. Landsittel, *Sales Mgr.* E. J. Mary, McPherson, Kans., *Ref. Supt.* C. A. Berger, *Ch. Chem.* J. E. Vilm, *Pur. Agt.* E. R. Walcher, *Traf. Mgr.* Refinery located at McPherson, Kans.

Globe Oil & Refining Co., The, (Oklahoma), Globe Bldg., Wichita, Kans.

I. A. O'Shaughnessy, *Pres.* F. L. Jehle, *V.P.* and *Gen. Mgr. Ref.* E. A. Lentz, *Sec.* and *Treas.* A. E. Landsittel, *Sales Mgr.* Refinery located at Blackwell, Okla.

Gilmore Oil Co., 2423 E. 28th St., Los Angeles, Calif.

E. B. Gilmore, *Pres.* C. S. Beesemyer, S. M. Salisbury, *V. P.s.* S. A. McNell, *Sec.* J. L. Coates, *Treas.* H. Alber, Jr., *Sales Mgr.* H. L. Eggleston, *Gen. Mgr. Ref.* Harold Marsh, *Gen. Supt. Ref.* Ray Pierson, *Ch. Chem.* E. L. Tobias, *Ch. Engr.* Mark Payne, *Pur. Agt.* Paul H. Moore, *Traf. Mgr.* Refineries located at Los Angeles and Santa Maria, Calif.

Golden Bear Oil Co., 325 W. Eighth St., Los Angeles, Calif.

S. R. Roseberg, *Chm. Bd.* J. M. Feldman, *Pres.* and *Sales Mgr.* Charles P. Prewett, *V. P.* and *Gen. Mgr.* Louis L. Swarthe, *Sec.* and *Treas.* M. B. Pardew, Oildale, *Ref. Supt.* William K. Nelson, *Ch. Chem.* Refinery located at Oildale, Calif.

Goodson Oil Co., Inc., Box 387, Sandoval, Ill.

S. A. Goodson, *Pres.* Refinery located at Sandoval, Ill.

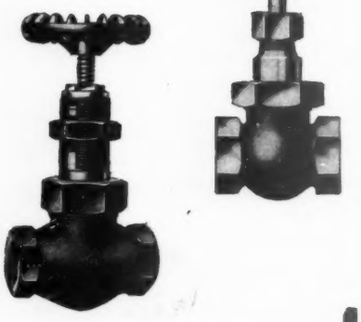
Gordon Refining Co., Gordon, Neb.

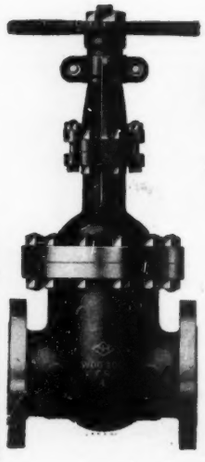
William F. Hewett, *Owner.* Kenneth French, *Gen. Mgr. Ref.* Refinery located at Gordon, Neb.

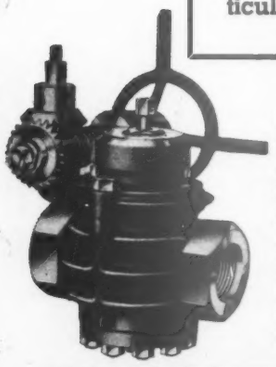
Used throughout the Oil Industry...

NH VALVES

for the oil industry cover a wide range of specialized productions. Gate, Stop and Check Valves for high pressures and temperatures, steam, oil and gas, and for general purposes. Also Newman-Milliken Glandless Lubricated Plug Valves for Christmas Trees and all oil field purposes. Working pressures to 3,000 lbs. per sq. inch. (Tested to 6,000 lbs. per sq. inch Kerosene.) Made in various metals to suit particular services.







The Newman-Milliken Glandless Lubricated Plug Valve has many unique features . . . a parallel plug always in close working contact with its body seating—no grit can therefore get between these two surfaces. No gland, no packing, no gaskets. Self sealing and a visual check on full lubrication. Port openings equal to full size area. Opened and closed by a quarter turn of the plug.

Newman, Hender & Co. Ltd

WOODCHESTER NH GLOS. ENGLAND.

Gramps Oil & Refining Corp., 616 Majestic Bldg., Denver, Colo.

Gerald Hughes, *Chm. Bd.* Lafayette M. Hughes, *Pres.* William E. Hughes, *V. P.* and *Treas.* Lafayette M. Hughes, Jr., *V. P.* Charles J. Hughes, *V. P.* and *Sec.* S. S. Hampton, *Sales Mgr.* F. E. Shelly, *Gen. Mgr. Ref.* R. McCarty, *Ref. Supt.* F. Odgers, *Ch. Chem.* Refinery located at Alamosa, Colo.

Gratex Refining & Fuel Oil Co., Box 307, Graham, Tex.

E. R. Marchman, *Gen. Mgr. Ref.* Claud Humphrey, *Supt.* Refinery located at Graham, Tex.

Gray Refinery, Inc., Newcastle, Wyo.

D. O. Gray, *Pres.* P. T. McAvoy, *V. P.* E. Mae Gray, *Sec.* W. D. Gray, *Gen. Supt. Ref.* Refinery located at Newcastle, Wyo.

Greenville Refining Co., Inc., Route 3, Greenville, Ky.

H. A. Henry, *Pres.* H. A. Henry, Jr., *V. P.* and *Pur. Agt.* M. J. Henry, *Sec.* and *Treas.* Plant located at Greenville, Ky.

Gulf Oil Corp.-Gulf Refining Co., P. O. Box 1166, Pittsburgh, Pa.

W. L. Mellon, *Chem. Bd.* (Gulf Oil Corp.). F. A. Leovy, *Chm. Bd.* (Gulf Refining Co.) and *V. Chm. Bd.* (Gulf Oil Corp.). J. F. Drake, *Pres.* E. C. Bothwell, W. V. Hartmann, William A. Slater, *V. P.s.* H. A. Gidney, *V. P.* and *Comptroller.* David Proctor, *Sec.* J. E. Nelson, *V. P.* and *Treas.* T. J. Sullivan, *Gen. Mgr. Ref.* C. M. Gile, *Gen. Mgr. Refined Oil Sales.* R. M. Bartlett, *Gen. Mgr. Fuel Oil Sales.* H. P. Hobart, *Gen. Mgr. Lube Oil Sales.* Herbert Henderson, *Mgr-Engin. and Constr.* H. G. Smith, *Mgr. Ref. Tech. Div.* Donald G. Clark, *Dir. of Pur.* A. J. Bessolo, *Traf. Mgr.* B. H. Barnes, *Gen. Supt. in Texas.* G. I. Roberts, R. C. Faulkner, *Asst. Gen. Supts.* Charles R. Stevenson, *Plant Mgr.*, Port Arthur. H. Taylor, Fort Worth; J. W. Schriever, Sweetwater; H. V. Sanderson (*Mgr.*) William M. Braybrooks, Staten Island; W. M. Crockett, *Supt.*; J. E. Biggins, R. S. Crockett, R. C. Roether, *Asst. Supts.*, Philadelphia; J. O. Timms, *Supt.*; J. H. Wackenhut, *Asst. Supt.*, Pittsburgh; D. E. Hart, *Supt.*; C. R. Summers, Jr., *Asst. Supt.*, Toledo; Thomas J. Twomey, *Supt.*; A. A. Niehenke, *Asst. Supt., Cleves.* Refineries located at Port Arthur, Tex.; Fort Worth, Tex.; Sweetwater, Tex.; Staten Island, N. Y.; Philadelphia, Pa.; Pittsburgh (Neville Island), Pa.; Toledo, and Cincinnati (Cleves), Ohio.

H

H. & T. Reclaiming & Refining Plant, Chase, Kans.

G. V. Taylor, *Owner.* Arthur N. Taylor, *Supt.* Refinery located at Chase, Kans.

Hamman Exploration Co., 2131 San Felipe Road, Houston, Tex.

John Hamman, *Pres.* John Hamman, Jr., *V. P.* and *Sales Mgr.* George F. Hamman, *V. P.* Mrs. Francis Hamman, *Sec.* and *Treas.* Roy W. Machen, *Gen. Supt.* Refinery located at Bay City, Tex.

Hancock Oil Co. of California, The, Box 810, Long Beach, Calif.

Will J. Reid, *Pres.* G. P. Deane, E. E. Pyles, *V. P.s.* John W. Hancock, *Sec.* W. T. Hancock, *Treas.* and *Gen. Supt. Ref.* C. B. Limbocker, *Mgr. Gasoline Sales.* H. S. Holloway, *Mgr. Fuel Oil Sales.* H. T. Boehme, *Asst. Supt.* R. G. Lovell, *Mgr. R. & D.* F. LaVerne Smith, *Ch. Chem.* William Westergard, *Pur. Agt.* H. T. McComb, *Traf. Mgr.* Refinery located at Long Beach (Signal Hill), Calif.

Hannah-Porter Co., Shelby, Mont.

M. E. Porter, *Pres.* L. R. Hannah, *V. P.* and *Sales Mgr.* S. W. Hannah, *Treas.* Pat Buckley, *Gen. Mgr. Ref.* Refinery located at Sweetgrass, Mont.

Harbor Terminal Oil Co., Wilmington, Calif.

Refinery located at Wilmington, Calif.

Harbor Refining Co., 2240 South St., Long Beach, Calif.

H. A. McOwen, *Pres.* and *Gen. Mgr. Ref.* D. D. Dunlap, *V. P.* C. E. Duke, *Sec.* and *Treas.* Harold L. Beckley, *Gen. Supt.* Keith A. Pearce, *Traf. Mgr.* Refinery located at Long Beach, Calif.

Hart Refineries, Missoula, Mont.

H. D. Hichenbottom, *Treas.* Refinery located at Missoula, Mont.

Heffington Petroleum Co., 2401 E. Sixth St., Austin, Tex.

Steve Heffington, Jr., *Owner.* A. J. Allen, *Ref. Supt.* Refinery located at Austin, Tex.

Henderson, J. A., Box 2107, Billings, Mont.

J. A. Henderson, *Owner.* Plant at Powell, Wyo.

Hi-Way Refining Co., Rosebud, Mich.

Refinery located at Rosebud, Mich.

Hole Brothers Refinery, Cut Bank, Mont.

B. V. Hole, Sr., and S. A. Hole, *Partners.* B. V. Hole, Sr., *Sales Mgr.* S. A. Hole, *Gen. Mgr. Ref.* and *Pur. Agt.* I. M. Hole, *Gen. Supt.* Refinery located at Cut Bank, Mont.

Home Oil & Refining Co., Box 1239, Great Falls, Mont.

W. E. Rice, *Pres.* John Rice, *V.P.* and *Gen. Mgr. Ref., Sales Mgr. Whlse.* Fred Erickson, *Sec. Treas.*, and *Pur. Agt.* W. E. Rice, Jr., *Sales Mgr. Retl.* Garret Hoback, *Gen. Supt.* Marvin Jenkins, *Asst. Supt.* Boyd Morris, *Mgr. R. & D.* Vernon May, *Ch. Chem.* Frank Fogarty, *Traf. Mgr.* Refineries located at Great Falls and Conrad, Mont.

Hot Springs Refining Co., Hot Springs, S. D.

E. M. Wells, *Pres.* and *Gen. Mgr.* C. M. Foster, *V. P.* Plant located at Hot Springs, S. D.

Houston Oil Co. of Texas, Box 2412, Houston, Tex.

David Hannah, *Chm. Bd.* George A. Hill, Jr., *Pres.* L. S. Zimmerman, *V. P.* and *Treas.* A. H. Kennerly, *Sec.* J. B. Benson, *Sales Mgr.* R. R. Hobson, *Gen. Mgr.* F. Y. Hutchison, *Gen. Supt. Ref.* George H. Hartung, *Supt.* R. H. Cook, *Ch. Chem.* O. S. Cummings, *Pur. Agt.* P. W. Schumacher, *Traf. Mgr.* Refinery located at Corpus Christi (Viola), Tex.

Howard County Refining Co., Big Spring, Tex.

R. T. Piner, *Pres.* Joseph Edwards, *V. P.* and *Gen. Mgr.* G. H. Hayward, *Sec.* and *Treas.* J. Henry Edwards, *Sales Mgr.* Refinery located at Big Spring, Tex.

H. S. & B. Refining Co., Mill Shoals, Ill.

W. R. Hull, H. H. Stouffer, W. H. Boughter, Decatur, Ill., *Owners.* Refinery located at Mill Shoals, Ill.

Humble Oil & Refining Co., Box 2180, Houston, Tex.

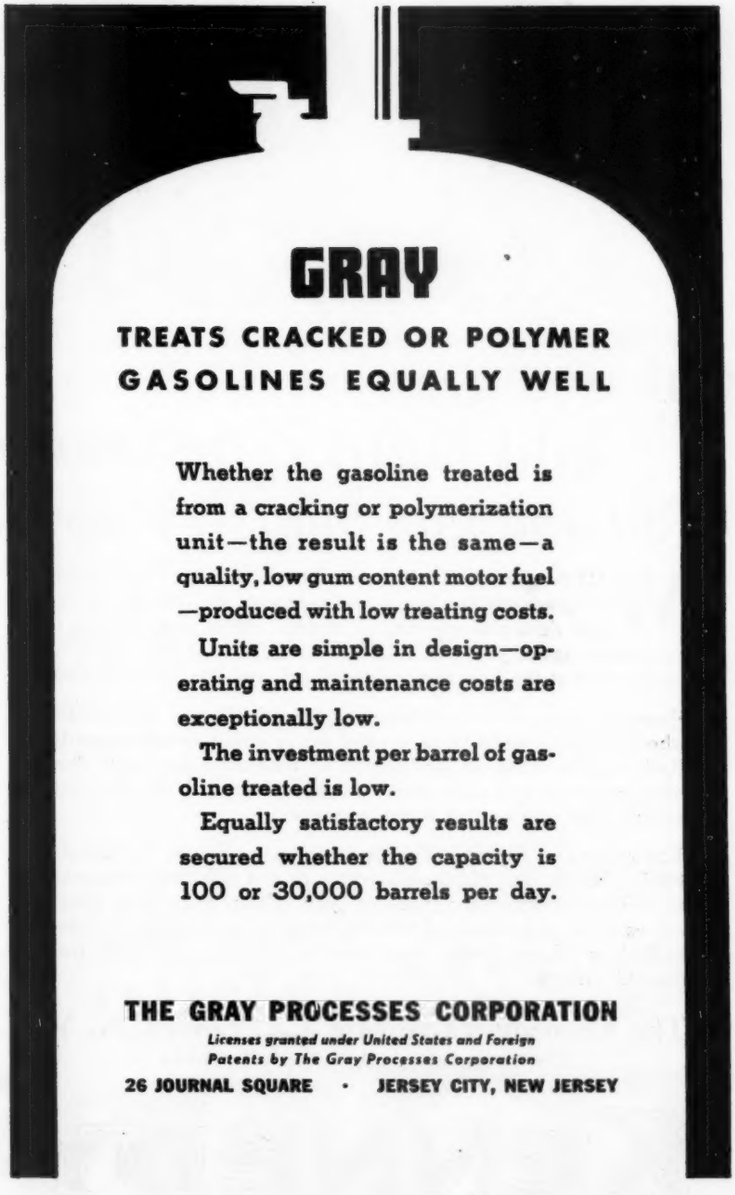
R. F. Blaffer, *Chm. Bd.* and *Treas.* H. C. Wiess, *Pres.* Hines H. Baker, *V.P. chg. Ref.* James Anderson, John R. Suman, L. T. Barrow, *V.P.s.* D. B. Harris, David Frame, *Dirs.* H. K. Arnold, *Sec.* M. J. Monroe, *Sales Mgr. Whsle.* D. T. Monroe, *Sales Mgr. Retl.* E. F. Voss, *Mgr. Ref.* G. L. Farned, *Supt.*; James Harrop, *Asst. Supt.*; M. L. Snyder, *Process Supt.*, Baytown. H. F. Goss, *Supt.*; W. H. Barber, *Asst., Supt.*, Ingleside C. M. Bell, *Supt.*; E. H. Seeley, *Asst. Supt.*, San Antonio. C. M. Dennison, Neches, *Supt.* H. D. Wilde, Jr., *Mgr. R. & D.* F. A. Watts, *Pur. Agt.* C. H. McNair, *Traf. Mgr.* Refineries located at Baytown, Ingleside, San Antonio and Neches, Tex.

Hunt, Eugene, Lewiston, Mont.

Eugene Hunt, *Owner* and *operator.* Refinery located at Winnett, Mont.

Hurricane Petroleum Corp., First Natl. Bank Bldg., Shreveport, La.

Refineries located at Overton and Arp, Tex.


GRAY
TREATS CRACKED OR POLYMER GASOLINES EQUALLY WELL
Whether the gasoline treated is from a cracking or polymerization unit—the result is the same—a quality, low gum content motor fuel—produced with low treating costs.
Units are simple in design—operating and maintenance costs are exceptionally low.
The investment per barrel of gasoline treated is low.
Equally satisfactory results are secured whether the capacity is 100 or 30,000 barrels per day.
THE GRAY PROCESSES CORPORATION
Licenses granted under United States and Foreign Patents by The Gray Processes Corporation
26 JOURNAL SQUARE · JERSEY CITY, NEW JERSEY

Husky Refining Co., Box 380, Cody, Wyo.
Glenn E. Nielson, *Pres.* Charles E. Baker, *V.P.* Roland F. Cowley, *Sec.* Kenneth C. Lindsey, *Treas.* C. M. Ehlen, *Sales Mgr.* James H. Shepard, *Gen. Supt. Ref.* John B. Kimes, *Ref. Supt.* Kenneth E. Dyer, *Ch. Chem.* Harold Brummond, *Traf. Clerk.* Refinery located at Cody, Wyo.

Hynes Refining Co., Hynes, Calif.
Refinery located at Hynes, Calif.

I

Idaho Refining Co., Pocatello, Idaho.
Gilbert Sheets, *Pres.* Henry D. Moyle, *V. P.* Frank L. Copening, Jr., *Sec.* John H. Peterson, *Treas.* Gilbert D. Moyle, *Gen. Mgr.* D. F. Gerstenberger, *Gen. Supt. Ref.* W. M. Miller, Jr., *Ref. Supt.* E. V. Smith, *Asst. Supt.* G. L. Farnsworth, *Ch. Chem.* Refinery located at Pocatello, Idaho.

Independent Refining Co. of Michigan, Flat Rock, Mich.
West H. Gallogly, *Pres.* Thomas L. Lott, *V. P.* Edward H. Yost, *Sec.* Roland O'Neil, *Treas.* and *Pur. Agt.* West H. Gallogly, *Gen. Mgr. Ref.* James T. Pokorney, *Gen. Supt. Ref.* and *Ch. Chem.* Refinery located at Flat Rock, Mich.

Independent Ref. Co., Peoples Natl. Bank Bldg., Tyler, Tex.
Partnership: W. R. Skeen, Joe B. Skeen, A. L. Skeen, Ecta Walters, Ben T. Parish, F. O. Penn. and C. W. Curtis. C. Zimmerman, *Ref. Supt.* Refinery located at Arp, Tex.

Independent Refinery, Lusk, Wyo.
Chis Joss, *Owner* and *Operator.* Plant located at Lusk, Wyo.

Independent Refining Co., Box 1535, Billings, Mont.
W. E. Rice, *Pres.* D. E. Hageman, *V. P.* F. H. Hietzhausen, *Sec.* and *Treas.* P. A. Thomson, *Sales Mgr.* and *Pur. Agt.* C. A. Cromwell, *Ref. Supt.* J. M. Williams, *Ch. Chem.* Refinery located at Laurel, Mont.

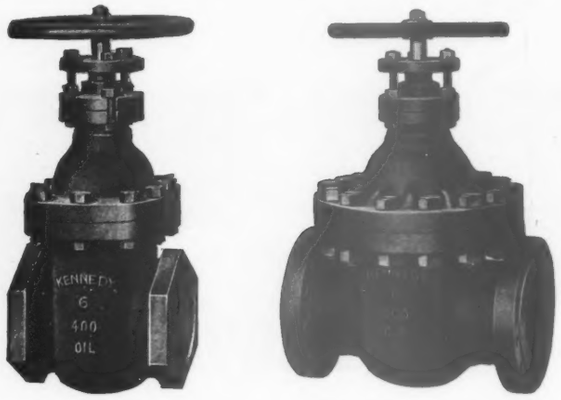
Indiana Farm Bureau Cooperative Association, Inc., Indianapolis, Ind.
J. B. Cummins, *Pres.* Everette Jeanes, *Sec.* M. J. Briggs, *Treas.* I. H. Hull, *Gen. Mgr.* J. Ivan Harris, *Sales Mgr.* Ralph L. Booker, *Gen. Mgr. Ref.* and *Pur. Agt.* R. J. Potts, Box 271, Mount Vernon, Ind., *Gen. Supt.* Raymond Jones, *Asst. Supt.* Eugene Johnson, *Ch. Chem.* C. S. Whitman, *Ch. Engr.* Russell Carroll, *Traf. Mgr.* Refinery located at Mount Vernon, Ind.

Indian Refining Co. (subsidiary of the Texas Co.), Lawrenceville, Ill.
W. S. S. Rodgers, *Pres.* M. Halpern, *V. P. Ref. Dept.* H. W. Dodge, S. B. Wright, *V. P.s.* R. L. Saunders, *Sec.* L. H. Lindeman, *Treas.* W. F. Moore, *Mgr. Pur. Dept.*, New York City. G. B. Bogart, *V. P.*; A. M. Martin, *Supt. Ref.*, Lawrenceville. W. Hochuli, Chicago, *V. P.* Refinery located at Lawrenceville, Ill.

Industrial Oil & Refining Co., 8640 Rheems Ave., Southgate, Calif.
L. E. Allen, *Owner.* D. H. Chapman, *Ref. Mgr.* Refinery located at Southgate, Calif.

Inland Empire Refineries, Inc., Box 6188, Spokane, Wash.
Wm. H. McIntyre, *Pres.* Henry D. Moyle, *V.P.* D. F. Gerstenberger, *Gen. Mgr.* T. Donald Greer, *Sec.* Wm. J. Doherty, *Treas.* R. T. Williams, *Asst. Mgr.* A. G. Coppins, *Gen. Supt.* Rex Gleave, *Ch. Chem.* Refinery located at Spokane, Wash.

Interstate Oil Corp., Taft, Calif.
F. B. Gormley, *Receiver.* Refinery located at Taft, Calif.



Right design and right construction
for oil and gas industry service

WHEN you close a Kennedy Valve, you will find ample leverage on the handwheel, smooth positive operation, and tight closure without strain. When the valve is to be opened again, you will find instant release of the operating mechanism at the first turn of the wheel, and free, easy motion.

Kennedy Valves are built to work effectively and dependably whether they are operated several times a day or infrequently. Each type is designed and tested to withstand far more than rated pressure and their ample margin of strength also protects against pipe strains and water hammer.

The extensive Kennedy line includes gate valves, for 250-lb., 400-lb., 500-lb. and 800-lb. oil, water or gas working pressures, as well as many other types of gate, globe, angle and check valves for a wide range of service, together with standard types and sizes of malleable iron screwed fittings and cast iron flanged fittings.

The Kennedy Valve Mfg. Co., Elmira, N. Y.
Representatives in principal oil centers.

KENNEDY
VALVES with Extra Value

J

Jacksboro Refining Co., Jacksboro, Tex.
F. W. Kendrick and A. T. Gray, *Owners.* Refinery located at Jacksboro, Tex.

Johnson, A. L., Wayne, Ohio.
A. L. Johnson, *owner.* Plant located at Wayne, Ohio.

Johnson Oil Refining Co., 20 N. Wacker Drive, Chicago, Ill.
James J. Johnson, *Chm. Bd.* I. H. Johnson, *Pres.* L. Ralph Johnson, Cleveland, Okla., *V. P.* and *Gen. Mgr. Ref.* G. C. Lilly, *Sec.* J. O. Horton, *Treas.* Henry G. Plane, *Sales Mgr. Whsle.* Melville C. Hill, *Sales Mgr. Retl.* W. J. Leenhouts, *Gen. Supt.* R. B. Fowler, *Process Supt.* Franklin P. Frey, *Ch. Chem.* V. C. Goward, *Pur. Agt.* G. A. Mindeman, Cleveland, *Traf. Mgr.* Refinery located at Cleveland, Okla.

Johnson Oil Supply, Box 239, Gary, Ind.
Harold Johnson, Gerald Johnson, Tom Johnson *(Partnership).* L. A. Rountree, *Gen. Supt. Ref.* Gerald Johnson, *Ch. Chem.* L. A. Rountree, *Ch. Engr.* Harold Johnson, *Pur. Agt.* and *Traf. Mgr.* Refinery located at Gary, Ind.

Johnston, E. C., Co., Vicksburg, Miss.
E. C. Johnston, *Owner.* A. C. Marble, *Gen. Mgr Ref.* E. E. Peveto, *Supt.* Refinery located at Vicksburg, Miss.

Joplin Refining Co., Box 155, Joplin, Mo.
Joseph F. Jones, *Gen. Mgr.* Richard O'D. Jones, *Gen. Supt.* K. N. Roe, *Ch. Chem.* Refinery located at Joplin, Mo.

K

Kanotex Refining Co., Arkansas City, Kans.
C. M. Boggs, *Pres.* W. L. Lesh, *V. P.* and *Sales Mgr.* E. K. Childers, *Sec.* R. R. Cox, *Treas.* F. A. Deering, *Ref. Supt.* D. R. Patterson, Jr., *Ch. Chem.* Dodson Givens, *Ch. Engr.* L. E. Watts, *Pur. Agt.* C. E. Varner, *Traf. Mgr.* Refinery located at Arkansas City, Kans.

Kendall Refining Co., P. O. Box 364, Bradford, Pa.
Otto Koch, *Pres.* and *Treas.* Joseph H. Bovaird, *V. P.* J. B. Fisher, *Exec. V. P.* and *Sec.* T. O. Grisell, *Sales Mgr. Branded Lube Oil and Greases.* R. A. Keck, *Sales Mgr. Branded Gasoline.* J. B. Fisher, *Sales Mgr. other products.* E. E. Brown, *Ref. Mgr.* W. B. McCluer, *Mfg. Supt.* F. J. Healy, *Ref. Supt. Dewaxing and Deresining Plant.* W. B. McCluer, *Mgr. R. and D.* S. M. Wolbert, *Ch. Engr.* F. W. Wodrich, Jr., *Pur. Agt.* James S. White, Jr., *Traf. Mgr.* Refinery located at Bradford, Pa.

Kern Oil Co., Ltd., 354 S. Spring St., Los Angeles, Calif.
George W. Ivey, *Chm. Bd.* Herbert Towers, *Sec.* A. P. McEachern, *Sec.*, Los Angeles. R. M. Kennett, *Sales Mgr. Whlse.* M. F. Dolan, *Sales Mgr. Retl.* Charles Drader, *Gen. Mgr.* H. C. Drader, *Pur. Agt.* Refinery located at Pico, Calif.

Keystone Oil Refining Co., 12800 Northampton, Detroit, Mich.
William Fisher, *Pres., Treas., Sales Mgr.* and *Pur. Agt.* Nathan R. Epstein, *V. P.* Leon Kay, *Sec.* and *Gen. Supt. Ref.* Refinery located at Detroit, Mich.

Knox Refining Co., Enid, Okla.
Charles E. Knox, *Owner.* Roy E. Raemer, *Sales Mgr.* Refinery located at Covington, Okla.

Kolingo Refining Co., Coalinga, Calif.
Refinery located at Coalinga, Calif.

Krieger Oil Co. of California, 225 W. Compton Blvd., Clearwater, Calif.
W. G. Krieger, *Pres.* and *Gen. Mgr.* Sam Goloman, *Sales Mgr.* V. R. Marichal, *Gen. Mgr. Ref.* and *Pur. Agt.* L. G. Haworth, *Plant Supt.* M. G. Folsom, *Ch. Chem.* Refinery located at Clearwater. Calif.

Krueger Oil & Refining Co., Natoma, Kans.
Refinery located at Laton (Natoma), Kans.

L

Lacy, Roger, Refinery, Box 591, Kilgore, Tex.
Roger Lacy, *Owner.* George Burrows, *Supt.* Refinery located at Kilgore, Tex.

Lake County Refinery, Polson, Mont.
Hilaire LeDoux, *Pres.* and *Gen. Mgr.* B. B. Owen, *V. P.* T. R. Delaney, *Sec.* and *Treas.* Refinery located at Polson, Mont.

Lake Refining Co., Box 391, Centralia, Ill.
Paul L. Hale, *Trustee,* 115½ N. Locust St., Centralia, Ill. Refinery located at Salem, Ill.

Lakeside Refining Co., Kalamazoo, Mich.
L. W. Brummitt, *Pres.* Arthur Fleischman, *V. P.* Edward Fleischman, *Sec.* and *Treas.* D. G. Henderson, *Sales Mgr.* G. W. Hobson, *Gen. Supt.* Refinery located at Kalamazoo, Mich.

LaSalle Petroleum Corp., Box 576, Burkburnett, Tex.
P. D. Williams, *Pres.* and *Gen. Mgr.* W. J. Schnur. 612 Wright Bldg., Tulsa, Okla., *V. P.* Earl A. Robinson, *Sec.* and *Treas.* F. A. Jamieson, *Sales Mgr.* J. D. Riddle, *Foreman.* Refinery located at Burkburnett, Tex.

Leonard Refineries, Inc., E. Superior St., Alma, Mich.
J. W. Leonard, *Pres.* Reid Brazell, *V. P.* and *Treas.* Bernard M. Jones, *V. P.* and *Sec.* M. D. Vanderley, *Sales Mgr.* L. R. Kamperman, *Mgr. Bulk Sales.* R. W. Pollard, *Gen. Supt.*, Alma; Jesse E. Shaw, *Supt.*, St. Louis. Plants located at Alma and St. Louis, Mich.

Lion Oil Refining Co., Exchange Bldg., El Dorado, Ark.
Col. T. H. Barton, *Chm. Bd.* and *Pres.* T. M. Martin, *Exec. V.P.* A. F. Reed, *V. P. chg. Sales.* J. J. Allinson, *V. P. chg. Mfg.* J. E. Howell, *V. P. chg. Prod.* Jeff Davis, *Sec.* R. E. Meinert, *Treas.* J. W. Poole, *Asst. Mgr. Ref.* J. B. Rogerson, *Tech. Asst.* W. T. Evans, *Process Supt.* O. H. Rothe, *Process Engr.* F. R. Grant, *Mgr. R. & D.* W. M. Carney, *Ch. Chem.* R. L. Van Zandt, *Ch. Engr.* S. S. Baker, *Designing Engr.* R. E. Meinert, *Pur. Agt.* P. G. Anderson, *Traf. Mgr.* Refinery located at El Dorado, Ark.

Louisville Refining Co., 411 American Life Bldg., Louisville, Ky.
Eli H. Brown, Jr., *Pres.* J. Fred Miles, *V. P.* H. R. Smith, *Sec.* and *Treas.* R. D. Scott, *Sales Mgr.* J. Fred Miles, *Gen. Mgr. Ref.* J. J. Loudermill, *Ref. Supt.* H. R. Smith, Jr., *Ch. Chem.* H. R. Smith, *Traf. Mgr.* Refinery located at Louisville, Ky.

Lynch Refining Co., Kilgore, Tex.
Nathan Lynch, *Owner.* Pete Cashell, *Sales Mgr.* Harry Mathews. *Ref. Supt.* Paul Mathews, *Asst. Supt.* John A. Mings, *Pur. Agt.* Refinery located at Kilgore, Tex.

Mc

McBride Refining Co., Inc., Box 396, Edinburg, Tex.
H. L. McBride, *Pres.* and *Gen. Mgr. Ref.* Garland Clymore, *V. P.* Mrs. Dovie McBride, *Sec.* J. J. Howell, *Treas.* and *Sales Mgr. Whsle.* J. B. Wohlford, *Ref. Supt.* Refinery located at La Blanca (Edinburg), Tex.

McCallen Refining Co., Box 550, Huntington Beach, Calif.
M. M. McCallen, *Partner* and *Gen. Mgr.* R. F. Hildebrand, *Sales Mgr.* W. J. Fosbury, *Gen. Supt. Ref.* John F. Cooper, *Office Mgr.* Maynard H. Lobell, *Accnt.* Refinery located at Huntington Beach, Calif.

McMurrey Refining Co., Peoples Bank Bldg., Tyler, Tex.
M. H. McMurrey, *Pres.* V. E. Crawford, *Ch. Chem.* A. L. Cone, *Pur. Agt.* Fred P. Sewell, *Supt.* Refinery located at Tyler, Tex.

McNutt Oil & Refining Co., Box 1161, El Paso, Tex.
C. M. McNutt, *Pres.* C. E. McNutt, *V. P.* C. Blaine McNutt, *Sec.* and *Sales Mgr. Whsle.* J. T. McNutt, *Treas.* R. Earl Faith *Sales Mgr. Retl.* Cecil E. McNutt, *Gen. Mgr. Ref.* G. M. Ecord, C. F. Witz, O. B. Powell, H. J. Smith, *Supts.* W. P. Hill, *Ch. Chem.* P. A. Robinson, *Pur. Agt.* Refinery located at Brickland, N. M.

M

Macmillan Petroleum Corp., 530 W. Sixth St., Los Angeles, Calif.
R. S. Macmillan, *Pres.* S. M. Batterson, H. R. Macmillan, M. P. Macmillan, H. E. Boner, *V. Ps.* De-Witt Knox, *Sec.* and *Treas.* H. E. Boner, *Gen. Mgr. Ref.* W. H. Powell, *Ref. Supt.*, Long Beach. C. C. Benz, *Ref. Supt.*, El Dorado. George Ray, *Asst. Supt.*, El Dorado. S. E. Campbell, *Ch. Chem.* Refineries located at Long Beach Calif.; El Dorado. Ark.

Magnolia Petroleum Co., Magnolia Bldg., Dallas, Tex.
E. R. Brown, *Chm. Bd.* D. A. Little, *Pres.* L. S. Sinclair, *V. P.* and *Sales Mgr. Whsle.* George Miller *V. P.* and *Sales Mgr. Retl.* John W. Newton, *V. P.* and *Gen. Mgr. Ref.* Walace Hawkins, M. J. McLaughlin, J. L. Latimer, J. C. Stephens, *V. Ps.* R. R. Jackson, *Supt.* T. E. Schley, *Asst. Supt.*, Beaumont. J. W. Folmar, *Supt.* N. B. Marchbanks, *Asst. Supt.*, Fort Worth. C. S. Dickens, Corsicana. *Supt.* P. L. Smith, *Ch. Chem.* C. A. Knight, *Ch. Engr.* E. W. Gross, *Pur. Agt.* W. M. Maddox, *Traf. Mgr.* Refineries located at Beaumont, Fort Worth, and Corsicana, Tex.

Malco Refineries, Inc., Artesia, N. M.
M. E. Baish, *Pres.* L. R. Simon, *V. P.* R. A. Shugart, *Sec., Treas.* and *Pur. Agt.* R. L. Halley, *Sales Mgr* Lowell Naylor, *Gen. Mgr. Ref.* C. A. Baker, *Asst Supt.* A. C. Sturgis, *Mgr. R. & D.* Refinery located at Artesia, N. M.

Mangold & Tweedy, Long Beach, Calif.
Refinery located at Long Beach, Calif.

Maritime Oil Co., Box 2646, Houston, Tex.
L. F. Rothermel, *Pres.* and *Treas.* W. G. Rothermel, *V. P.* W. E. Glenn, *Sec.* W. C. Hildebrand, Jr., *Sales Mgr. Whsle.* J. A. McGuire, *Sales Mgr. Retl.* H. E. McMenemy, *Gen. Mgr. Ref.* Refinery located at Houston, Tex.

Marvel Refining Co., Box 38, Grand Rapids, Mich.
F. S. Grimes, *Pres.* F. L. Grimes, *V. P.* C. E. Grimes, *Treas.* C. A. Mitchell, *Gen. Supt.* G. A. Young, *Office Mgr.* Refinery located at Grand Rapids, Mich.

Medina Valley Refining Co., 516 San Marcus St., San Antonio, Tex.
O. R. Seagraves, *Pres.* J. B. Williams, *Gen. Supt.* Refinery located at Hondo, Tex.

Mercury Petroleum Corp., Box 7, Venice, Calif.
H. H. Biber, *Pres.* and *Gen. Mgr.* J. M. Stump, *V.P.* D. E. Biber, *Sec.* and *Treas.* D. E. Brown, *Sales Mgr.*

TURBINES THAT CAN "TAKE IT"!

From big efficient multi-stage condensing units down to small single-stage turbines, Elliott machines are built with that extra special ruggedness which is so much appreciated in refinery service.

Many a time they have shown that they can take punishment and keep going. They have a reputation for a brand of toughness not usually combined with the high efficiencies they develop.

You don't need to pamper an Elliott turbine. That is why oil industry engineers put them on vital drives. They can be supplied to run on steam or gas, under practically any pressure or temperature conditions, and any desired capacity. Get the facts — write.

ELLIOTT COMPANY
Steam Turbine Dept., JEANNETTE, PA.
DISTRICT OFFICES IN PRINCIPAL CITIES

H-644

ELLIOTT
TURBINES FOR DEPENDABLE DRIVES

and *Pur. Agt.* C. H. Lack, *Gen. Supt.* Refinery located at Venice, Calif.

Mertzon Refining Co., Box 222, Mertzon, Tex.
W. L. Jones, *Pres.* and *Gen. Supt.* R. M. Lurner, *V. P.* Mrs. Walter L. Jones, *Sec., Treas.* and *Pur. Agt.* T. L. Palmer, *Sales Mgr. Whsle.* O. L. Jones, *Sales Mgr. Retl.* Pat O'Neal, *Gen. Mgr. Ref.* T. L. Palmer, *Traf. Mgr.* Refinery located at Mertzon, Tex.

Mexican Petroleum Corp. of Georgia, 122 E. 42nd St., New York, N. Y.
E. G. Seubert, *Chm. Bd.* Dr. Robert E. Wilson, *Pres.* E. G. McKeever, *V. P.* D. J. Smith, *V. P.* and *Gen. Mgr. Ref.* J. A. Carroll, Jr., *V. P.* and *Treas.* D. H. Baker, *Sec.* C. F. Hatmaker, *Sales Mgr.* J. A. Whitely, *Pur. Agt.* J. S. Wood, *Traf. Mgr.* H. T. Hulin *Supt.*; H. A. Schano, *Asst. Supt.*, Savannah. Refinery located at Savannah, Ga.

Mid-Continent Petroleum Corp., Mid-Continent Bldg., Tulsa, Okla.
Jacob France, *Chm. Bd.* and *Pres.* E. M. Rouzer, J. C. Denton, G. O. Moody, F. B. Koontz, R. W. McDowell, Jess Scarborough, *V. P.s.* E. M. Rouzer, *Sec.* Charles Klein, *Treas.* F. B. Koontz, *Gen. Mgr. Ref.* D. G. Morgan, *Gen. Supt. Ref.* H. T. Bennett, *Mgr. R. & D.* and *Ch. Chem.* C. A. Prichard, *Pur. Agt.* Refinery located at West Tulsa, Okla.

Midland Oil Refining Co., 2300 Clermont St., Denver, Colo.
L. M. Hines, *Pres.* L. R. Hines, *Sec.* and *Treas.* Refinery located at Denver, Colo.

Mid-States Refining Co., Falls City, Neb.
R. D. Swan, *Pres.* Hugh J. Mitchell, *V.P. Sales, Sec.* and *Treas.* H. N. Whitaker, *Sales Mgr. Retl.* George Knupp, *Ref. Supt.* John Dyblie, *Ch. Chem.* William Buettner, *Pur. Agt.* Dwight Davis, *Traf. Mgr.* Refinery located at Falls City, Neb.

Mid-West Refineries, Inc., Alma, Mich.
B. J. Skinner, *Pres.* T. E. McFall, *V. P.* V. M. Skinner, *V. P.* and *Sales Mgr.* J. G. Marshall, *V. P.* and *Gen. Supt. Ref.* D. B. Smith, Alma; E. E. Thompson, Grandville; B. E. Thurston, Grand Rapids, *Asst. Supts.* Two plants located at Alma; one each at Grandville and Grand Rapids, Mich.

Minerva Refining Co., Box 388, Corsicana, Tex.
H. H. Coffield, *Pres.* C. A. Middleton, *V. P.* and *Supt.* Refinery located at Minerva, Tex.

Mohawk Petroleum Corp., 405 Montgomery St. San Francisco, Calif.
A. L. Marsten, *Pres.* Frank R. Long, Lewis A. Marsten, C. B. Stevenson, *V. P.s.* V. Foster, *Asst. Sec.* E. L. Rogers, *Gen. Supt. Ref.* V. K. Douglas, *Pur. Agt.* Refinery located at Bakersfield, Calif.

Monarch Refineries, Inc., Box 1283, Oklahoma City, Okla.
W. E. Steelman, *Pres.* D. G. Steelman, *Sec.* and *Treas.* H. H. West, *Gen. Supt.* Refinery located at Oklahoma City, Okla.

Montana Headlight Oil Co., Box 6187, Spokane, Wash.
Jerome L. Drumheller, *Pres.* D. M. Drumheller, Jr., Joseph Drumheller, *V. P.s.* Harl J. Searl, *Sec.* and *Pur. Agt.* C. F. G. Pattullo, *Treas.* Charles C. Peake, *Sales Mgr.* Will H. Hoppe, *Gen. Supt.* Refinery located at Spokane, Wash.

Montgomery, H. A., Co., Inc., 17191 Swift Ave., Detroit, Mich.
H. A. Montgomery, *Pres.* and *Gen. Mgr.* W. Montgomery, Stanley Neal, L. A. Dall, James W. Laws, Jr., *V. P.s.* F. Alexander, *Sec.* and *Treas.* E. A. Nill, *Gen. Supt. Ref.* Robert Egbert, *Asst. Supt.* Refinery located at Findlay, Ohio.

Moorcroft Refining Co., Moorcroft, Wyo.
Earl M. Dorris, *Pres.* and *Gen. Mgr. Ref.* L. G. Dorris, *Sec.* Plant located at Moorcroft, Wyo.

Morton Refining Co., Oilmont, Mont.
N. C. Morton and A. W. Morton, *Partners.* A. W. Morton, *Gen. Supt.* Refinery located at Oilmont, Mont.

Motor Fuels Corp., Box 978, Levelland, Tex.
H. R. Johnson, Tulsa, *Pres.* and *Treas.* J. H. McCoy, Columbus, Ohio, *V. P.* A. F. Boudreau, *Sec.*; H. R. Johnson, *Treas.*, Tulsa. J. O. Denton, Jr., *Sales Mgr.* and *Pur. Agt.* J. B. Simpson, R. C. Rich, *Supts.* W. N. Epler, *Ch. Chem.* E. L. Chesnut, *Traf. Mgr.* Refinery located at Levelland, Tex.

Moutray Oil Co., Abilene, Tex.
E. W. Moutray, *Pres., Sales Mgr. Whsle.* and *Gen. Mgr.* L. Paul Kirk, *V. P.* and *Sales Mgr. Retl.* Vera Middleton, *Asst. Sec.* Mrs. M. P. Moutray,

KEARSARGE ROD PACKING

For continued efficient service against high-pressure steam, you can't beat this rugged rod and plunger packing. Its unique folded construction provides natural resiliency and forms a reservoir for the preserving lubricant, keeping the packing pliable in service. Extra resiliency is provided by a red rubber expansion back in the center block. And a double wrapping of asbestos cloth assures resistance to wear. You can use Kearsarge Rod Packing, and other materials in the complete J-M line, to minimize equipment shutdowns ...save much of the expense caused by too-frequent *re*-packing.

For details, ask for a copy of the new J-M Packing Catalog. Johns-Manville, 22 E. 40th St., New York.

JM
Johns-Manville PACKINGS & GASKETS
THERE'S A DISTRIBUTOR NEAR YOU

USE MODERN METHODS AND IMPROVE YOUR PRODUCT

Treet-O-Control mounted on Mechanical Meter

BY ACCURATE TREATMENT WITH %PROPORTIONEERS% TREET-O-CONTROL

By the use of %Proportioneers% TREET-O-CONTROL for inhibitor addition a product of improved quality may be made since valuable constituents in the motor fuels are conserved at reduced operating costs.

Over eight years of actual field experience—over 3700 units now in service in the United States.

ADVANTAGES

1. **Accurate inhibitor percentages over wide gasoline flow range.**
2. **Metals and construction to suit any type of inhibitor.**
3. **Proportioning accuracy maintained during flow variations produced when loading mobile equipment.**
4. **Steam, air, gas, or electrical operation.**
5. **Capacities from 50 to 5000 g.p.m.**
6. **New lower prices.**

Write for Standard Methods 119 on the use of gum inhibitors and our general catalog TOU 6 describing other refinery applications.

PARTIAL LIST OF INSTALLATIONS*
Mid-Continent Petroleum Corp.
Oil Well Engineering
Standard Oil of Ohio
Socony Vacuum Oil Co.
Universal Oil Products Co.
Texas Company
Oil Well Engineering
Gulf Refining Co.
* Each Refinery listed is using two or more Treet-O-Units.

%PROPORTIONEERS, Inc.%
"Chemical Feeder Headquarters"
35 CODDING ST. PROVIDENCE, R. I.

Treas. O. L. Snyder, *Gen. Supt.* C. N. Cameron, *Ch. Chem.* Refinery located at Hawley, Tex.

N

Naph-Sol Refining Co., Box 207, Muskegon, Mich.
Walter E. Anderson, *Pres.* S. A. Steffen, *V. P.* A. W. Penny, *Sec.* C. S. Walkowiak, *Treas.* B. L. Snyder, *Sales Mgr.* W. E. Anderson, *Gen. Mgr. Ref.* William H. Gannon, *Gen. Supt. Ref.* Leonard Wenzer, Hal B. Burrell, *Supts.* H. R. Marquand, *Ch. Chem.* Leonard Wenzer, *Pur. Agt.* J. A. Sundquist, *Traf. Mgr.* Refinery located at Muskegon, Mich.

National Refining Co., The, 500 Hanna Bldg., Cleveland, Ohio.
W. H. Lamprecht, II, *Chm. Bd.* Paul Ryan, *Pres.* Louis S. Pierce, *V. P.* and *Sec.* R. E. Channock, *Asst. Treas.* H. W. Kuegler, *Whlse. Sales Mgr.* K. R. Proctor, *Acting Sales Mgr. Retl.* Thomas G. Elder, *Gen. Mgr. Ref.* Fred Bergen, *Supt.;* C. A. Peterson, *Asst. Supt.;* W. C. Mitchell, *Ch. Chem.;* W. H. Humphreys, *Ch. Engr.,* Findlay. J. B. Gillam, *Supt.;* R. L. Vawter, *Asst. Supt.;* Thomas Naudet, *Ch. Chem.;* E. L. Richardson, *Ch. Engr.,* Coffeyville. S. A. White, *Pur. Agt.* Henry Mansell, *Acting Traf. Mgr.* Refineries located at Findlay, Ohio, and Coffeyville, Kans.

New Santa Maria Refining Co., Santa Maria, Calif.
Mrs. Mable Coates, *Mgr.* Refinery located at Santa Maria, Calif.

North American Refining Co., Chinook, Mont.
M. W. Vrooman, *Supt.* Refinery located at Chinook, Mont.

North La Barge Oil Co., Frontier, Wyo.
Susan J. Quealy, *Pres.* Jos. A. Minton, *V. P.* and *Gen. Mgr.* R. M. Turner, *Sec.* and *Treas.* Robert J. Minton, *Supt.* Refinery located at La Barge, Wyo.

North Texas Refining Co., Box 575, Gainesville, Tex.
R. L. Knight and J. R. Sullivan, *Owners.* Refinery located at Gainesville, Tex.

Northwestern Petroleum, Box 467, Newcastle, Wyo.
F. W. Palis, *Owner* and *Mgr.* Ivan T. Minter, *Gen. Supt.* Refinery located at Osage, Wyo.

Northwestern Refining Co., Box 72, St. Paul Park, Minn.
Arthur T. Erickson, *Pres.* Godfrey J. Erickson, *V. P.* Ivar C. Erickson, *Sec.* and *Treas.* Elmer R. Erickson, *Sales Mgr.* Weldon R. Burns, *Gen. Supt. Ref.* Herbert Davidson, *Ch. Chem.* Refinery located at St. Paul Park, Minn.

Northwest Refining Co., Cut Bank, Mont.
L. B. O'Neil, *Pres.* T. J. Landry, *V. P. chg. Ref.* G. N. McCabe, *V. P. chg. Sales.* R. W. Wood, *Asst. Supt.* R. W. Burns, *Ch. Chem.* A. T. Bowen, *Pur. Agt.* and *Traf. Mgr.* Refinery located at Cut Bank, Mont.

Norwalk Co., The, 437 S. Hill St., Los Angeles, Calif.
Lionel T. Barneson, *Pres.* J. L. Barneson, H. J. Barneson, *V. P.s.* W. E. Kropp, *Sec.* Frank E Davis, *Sales Mgr.* H. M. Paulsen, *Gen. Mgr. Ref.* K. E. Grigsby, *Ref. Supt.* H. W. Ball, E. C. Spencer, *Asst. Supts.* K. S. Ritchie, *Mgr. R. & D.* R. C. Boroff, *Pur. Agt.* Refinery located at Maricopa, Calif.

Nueces Refining Co., Clarkwood, Tex.
F. L. Tolleson, *Sales Mgr. Whsle.* P. E. Cravy, *Sales Mgr. Retl.* W. L. Goodson, *Gen. Mgr. Ref.* Walter M. Johnson, *Gen. Supt. Ref.* Roy Byerley, *Asst. Supt.* J. M. Harris, *Mgr. R. & D.* Jack Bell, *Ch. Chem.* M. N. Johnson, *Ch. Engr.* Roy E. Smith, *Pur. Agt.* and *Traf. Mgr.* Refinery located at Clarkwood, Tex.

O

Ohio Oil Co., The, 539 S. Main St., Findlay, Ohio.
O. D. Donnell, *Gen. Mgr.* and *Pres.* C. L. Fleming, John McFadyen, W. W. Fleming, J. C. Donnell, II, G. E. McCullough, R. C. Gwilliam, F. R. Clark, *V. P.s.* E. B. Redpath, *Sec.* F. A. Billstone, *Treas.* C. L. Fleming, *Gen. Mgr. Ref. and Mktg.* N. T. Stover, *Whlse. Sales Mgr.* R. E. Luton, *Gen. Supt. Ref.* E. A. Brown, *Asst. Gen. Supt. Ref.* H. E. Handy, *Supt.,* D. L. Winsett, *Asst. Supt.,* Robinson, Ill. J. R. Barrett, *Supt.;* H. L. Megan, *Asst. Supt.,* Fort Worth, Tex. B. B. Miller, *Supt.;* L. P. Foote, *Asst. Supt.,* Lovell, Wyo. C. A. Buechner, Ill. and Mo. Div.; J. H. Townsend, Ind. Div.; J. P. Hughes, Ky. Div.; R. R. Webb, Northern Ohio Div.; R. W. Palmer, Southern Ohio Div.; J. C. McCoy, Tex. Div. *Retl. Div. Sales Mgrs.* T. W. Culmer, *Ch. Chem.* R. W. S. Musgrave, *Ch. Engr.* C. S. Sherk, *Pur. Agt.* E. W. Evans, *Traf. Mgr.* Refineries located at Robinson, Ill.; Fort Worth, Tex.; Lovell, Wyo.

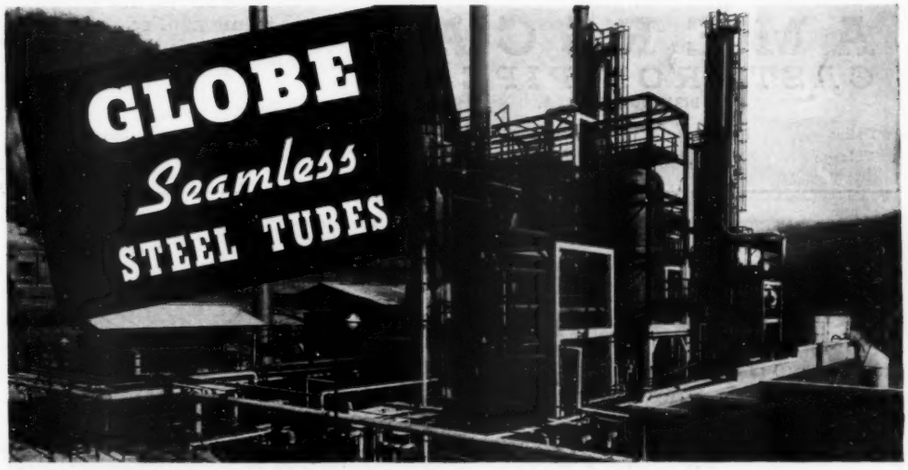
Oil Creek Refining Co., Drawer 506, Titusville, Pa.
Frank J. McGraw, *Pres., Treas.* and *Sales Mgr. Whsle.* George L. Craft, *V. P.* G. L. Ehrhart, *Sec.* and *Sales Mgr. Retl.* F. H. Burow, *Gen. Supt. Ref.* George McGraw, *Asst. Supt.* George J. Acton, *Ch. Chem.* Daniel C. Beck, *Ch. Engr.* Refinery located at Titusville, Pa.

Old Dutch Refining Co., Box 418, Muskegon, Mich.
E. J. Bouwsma, *Pres.* Paul Scholten, *V. P.* E. F.

SPECIAL VIKING UNIT FOR OIL FIELD PUMPING SERVICE

IT'S got everything . . . a rugged, heavy-duty pump that is self-priming on suction lifts up to 20 ft. and pumps against pressures of 50 to 100 lbs.—pump operates at 30, 55 and 90 GPM . . . a hand operated, standard Ford type transmission with 3 speeds forward and one reverse . . . a compact, air-cooled "Caterpillar" gas-gasoline engine that produces from 4.0 to 5.5 H.P. The entire unit is mounted on a sturdy, structural steel base that makes movement to any part of the field a quick, simple task. Detailed specifications of pump, engine and transmission are listed in Bulletin 2800-40 . . . your request for a copy will be filled by return mail.

VIKING PUMP COMPANY
CEDAR FALLS IOWA



. . . CORROSION AND WEAR-RESISTANT FOR OIL PRODUCTION AND REFINING SERVICES

Specializing in the manufacture of seamless steel tubing, The Globe Steel Tubes Co. is a dependable source of supply for tubes for a wide range of oil production and refining services:

- CARBON AND ALLOY STEEL TUBES —corrosion and wear-resistant for well connections, mud pumps, dehydrators.
- SEAMLESS BOILER TUBES—for field boilers.
- STILL TUBES—Carbon, Carbon-moly, Low and Intermediate Chrome, Stainless Steel, Special Analyses for Catalytic and Polymerization Processes.
- CONDENSER AND HEAT EXCHANGER TUBES —corrosion and erosion-resistant Low Alloy and Stainless Steel Tubes for Refinery Service.

Consult Globe Steel Metallurgists on Tubing Problems.

GLOBE STEEL TUBES COMPANY
4011 W. Burnham Street MILWAUKEE, WIS.

GLOBE Seamless TUBES

Sondregger, *Gen. Mgr.* George A. Parmenter, *Sec.* J. H. Bender, *Treas.* John L. Dalson, *Sales Mgr. Whsle.* George Sharum, *Ref. Supt.* W. W. Hatfield, *Ch. Chem.* Refinery located at Muskegon, Mich.

Olney Oil & Refining Co., 1111 City Natl. Bank Bldg., Wichita Falls, Tex.
C. W. Cahoon, Jr., *Pres., Treas.* and *Gen. Mgr.* C. M. Crowell, *Sec.* Jack P. Slater, *Gen. Supt.* and *Pur. Agt.* C. C. Ellis, *Ch. Chem.* Refinery located at Olney, Tex.

Olympic Refining Co., 2425 California Ave., Long Beach, Calif.
Philip E. Johnson, *Exec. V. P.* and *Gen. Mgr.* S. R. Harding, *Sales Mgr.* H. W. Batcher, *Gen. Supt.* James H. McQuaigg, *Pur. Agt.* Refinery located at Long Beach, Calif.

Omar Refining Co., Tulsa, Okla.
F. S. Whitaker, *Chm. Bd.* and *Pres.* J. H. Whitaker, *V. P.* Refinery located at Garber, Okla.

Onyx Refining Corp., Box 330, Abilene, Tex.
O. B. Stephens, *Pres.* and *Gen. Mgr.* F. H. Murphy, *V. P.* and *Treas.* J. B. Self, *Sec.* and *Traf. Mgr.* I. H. Lantz, *Gen. Supt Ref.* Refinery located at Abilene, Tex.

Operators Oil & Refining Co., 2208 E. South St., Long Beach, Calif.
Refinery located at Long Beach, Calif.

Oriental Refining Co., Box 118, Denver, Colo.
A. L. Putnam, *Pres.* Max P. Zall, *V. P.* H. L. Jewell, *Sec.* R. K. Baker, *Treas.* P. A. Truesdell, *Sales Mgr.* K. P. Wilson, *Dir. R. & D.* K. B. Harton, *Auditor.* J. H. Horke, *Pur. Agt.* and *Traf. Mgr.* Arthur L. Smith, *Ch. Dispatcher.* Refinery located at Denver, Colo.

P

Pacific Central Refining Co., Santa Maria, Calif.
Refinery located at Santa Maria, Calif.

Pacific States Oil Co., 530 W. Sixth St., Los Angeles, Calif.
A. Garni, *Chm. Bd.* R. D. Matthews, *Pres.* H. H. Whitesel, *V. P.* G. G. Blanchard, *Sec.* and *Treas.* F. N. Epler, *Asst. Sec.* R. E. Holcomb, *Controller.* R. C. Colvin, Wilmington, *Gen. Supt. Ref.* E. L. Kay, *Ch. Chem.* W. F. Newman, *Pur. Agt.* Refinery located at Wilmington, Calif.

Palomar Refining Co., Box 1736, Bakersfield, Calif.
S. G. Turner, *Pres.* and *Treas.* F. C. Goetz, *V. P.* J. H. Catlin, *Sec.* W. R. Winton, *Asst. Sec.* and *Pur. Agt.* G. E. Brown, *Sales Mgr.* W. E. Osburn, *Ref Supt.* Refinery located at Bakersfield, Calif.

Paluxy Asphalt Co., 818 Gulf States Bldg., Dallas, Tex.
E. Constantin, Jr., *Pres.* E. F. Bourge, *V. P.* A. C. Delaney, *Sec.* and *Treas.* A. A. Spencer, *Sales Mgr.* H. J. Toups, *Supt.* Building refinery at Crupe, Miss.

Pan American Petroleum Corp., 122 E. 42nd St., New York, N. Y.
E. G. McKeever, *Pres.;* J. A. Carroll, Jr., *V. P.* and *Treas.;* D. H. Baker, *Sec.;* D. J. Smith, *Gen. Mgr. Ref.;* J. A. Whitely, *Pur. Agt.;* J. S. Wood, *Traf. Mgr.,* New York City. A. E. Ralston, Lee Circle, New Orleans, *V. P.* and *Sales Mgr.* F. W. Grey, *Supt.;* L. L. Robein, *Asst. Supt.;* J. D. Tufts, *Ch. Engr.,* Destrehan, La. Refinery located at Destrehan, La.

Pan American Refining Corp., 122 E. 42nd St., New York, N. Y.
E. G. Seubert, *Chm. Bd.* Dr. Robert E. Wilson, *Pres.* J. A. Carroll, Jr., *V. P.* and *Treas.* D. J. Smith, *V. P.* and *Gen. Mgr. Ref.* E. G. McKeever, *V. P.* D. H Baker, *Sec.* C. F. Hatmaker, *Sales Mgr.* J. A. Whitely, *Pur. Agt.* J. S. Wood, *Traf. Mgr.* P. J. Sweeny, *Supt.;* H. J. Broderson, S. B. Schapiro, *Asst. Supts.* R. H. Price, *Mgr. R. & D.,* Texas City. W. W. Hulin, *Supt.;* W. J. Mellendick, *Asst. Supt.,* Baltimore. Refineries located at Texas City, Tex., and Baltimore Md.

Pana Refining Co., Box 57, Pana, Ill.
C. Hayden Davis, *Pres.* Chase Savage, *V. P.* George Edward Day, *Sec.* R. A. Hose, *Treas.* E. G. Youngberg, *Sales Mgr.* H. W. Sullivan, *Gen. Supt.* Roy Hamilton, *Asst. Supt.* J. T. Chapman, *Ch. Chem.* Ray Hoffman, *Ch. Engr.* R. R. Bickel, *Traf. Mgr.* Refinery located at Pana, Ill.

Panda Oil & Refining Co., Inc., Congress St. and Maunce, Toledo, Ohio.
Glenn Thomas, *Pres.* and *Treas.* Charlotte Thomas, *V. P.* Vinita Thobit, *Sec.* Edward Thobit, *Sales Mgr.* Tony Rudnicke, *Gen. Mgr. Ref.* Seroy Tipton, *Traf. Mgr.* Refinery located at Toledo, Ohio.

Panhandle Refining Co., Box 1191, Wichita Falls, Tex.
Roy B. Jones, *Pres.* O. R. Burden, *Asst. to Pres.* R. C. Stanford, G. W. Reed, *V. P.s.* M. A. Chambers, *V. P.* and *Treas.* H. G. Collier, *Sec.* W. F. Sims, *Gen. Supt. Ref.,* Wichita Falls. J. C. Hester, *Supt.,* Lueders. E. W. Ellis, *Ch. Chem.* Roy J. Mann, *Pur. Agt.* J. H. Davenport, *Traf. Mgr.* Plants located at Wichita Falls and Lueders, Tex.

Pan Pacific Oil Co., Box 762, Long Beach, Calif.
F. Waller, *Pres., Sales Mgr.* and *Gen. Supt.* Alf Williams, *V. P.* S. H. Underwood, *Sec.* Frank Cisko, *Gen. Mgr. Ref.* Alex Trepani, *Ref. Supt.* Refinery located at Long Beach, Calif.

Paraffine Companies, Inc., The, 475 Brannan St., San Francisco, Calif.
R. S. Shainwald, *Chm. Bd.* W. H. Lowe, *Pres.* R. H. Shainwald, *Exec. V. P.* R. Hilliard, *V. P. chg. Sales.* F. M. Prince, *V. P. chg. Exports.* R. H. Ohea, *Sec.* C. C. Gibson, *Treas.* J. T. Coleman, *Gen. Mgr. Ref.* George Prifold, *Gen. Supt. Ref.* D. Bird, *Ref. Supt.* S. A. Cohen, *Mgr. R. and D.* W. B. Stitt, *Ch. Engr.* A. H. Silverstone, *Pur. Agt.* A. W. Brown, *Traf. Mgr.* Refinery located at Emeryville, Calif.

Pathfinder Petroleum Co., 811 W. Seventh St., Los Angeles, Calif.
H. A. Meek, *Pres.* B. E. Devere, *V. P.* Earl Glen Whitehead, *Sec.* W. H. Brownell, *Treas.* J. Vernon Pohl, *Sales Mgr. Whsle.* D. F. Wallace, *Sales Mgr. Retl.* L. Daams, *Gen. Mgr. Ref.* and *Pur. Agt.* J. B. Lester, *Gen. Supt. Ref.* Glenn Colner, *Supt.* George Ehrhart, *Mgr. R. & D.* A. J. Barrett, *Ch. Chem.* Refinery located at Los Alamitos, Calif.

Payward Refining Co., Shamrock, Tex.
Roy Scrivner, *Gen. Supt.* A. T. Gregg, *Asst. Supt.* Refinery located at Shamrock, Tex.

Pecos Diamond Refining Co., Inc., Box 485, Artesia, N. M.
G. A. Grober, *Pres.* Mrs. I. M. Grober, *V. P.* H. E. Harriman, *Sec.* and *Treas.* Refinery located at Artesia, N. M.

Peerless Oil Co., Saginaw, Mich.
Refinery located at Saginaw, Mich.

Pennsylvania Oil Products Refining Co., Warren, Pa.
M. F. Cowden, *Pres.* G. E. Cowden, *V. P.* H. E. Lawrence, *Sec.* W. H. Cowden, *Treas.* S. P. Stannard, Eldred, Pa., *Supt.* Refinery located at Eldred, Pa.

8" HIGH PRESSURE GAS LINE

MOLOX BALL & SOCKET PIPE

Photo shows final section of three sections, totaling 22,318 feet, of 8" Molox Ball & Socket Pipe installed as submarine high-pressure gas lines under Galveston Bay, replacing pipe line of substitute material which failed in service. This is a typical example of how Mono-Cast Centrifugal Pipe, equipped with modern bottle-tight, flexible joints has set a new standard for Cast Iron Pipe serving the gas and oil industry. For complete details address Acipco office nearest you.

AMERICAN CAST IRON PIPE CO.
BIRMINGHAM, ALA.

Dallas Houston El Paso Kansas City Los Angeles San Francisco
Chicago Minneapolis New York City Cleveland Pittsburgh

Preferred by Large Refining Companies

The two Regulators here seen are on a gas line leading to a Texas refinery, which is owned by one of the great oil-producing companies. Like all C-F low-pressure Regulators, they afford protection in case of failure of gas supply. Their merits include sturdy construction, sure precision, and long life, as well as convenience of installation and maintenance.

C-F 2" Low-Pressure Regulators with Automatic Cut-Off Attachment.

Write for new Catalog of Regulators for All Uses.

The CHAPLIN-FULTON MFG. CO.
28-40 PENN AVE. CF PITTSBURGH, PA.

Pennsylvania Refining Co., Butler, Pa.
John A. Beck, *Pres.* A. B. Weingard, *V.P.* Paul R. Beck, *Sec.* and *Treas.* M. H. Hindman, *Sales Mgr. Whsle.* V. L. Roberson, *Sales Mgr. Specialty Div.* Walter W. Beck, *Gen. Mgr. Ref.* George Kirkwood, Karns City; Adam Mosher, Titusville, *Supts.* John A. Beck, Jr., *Mgr. R. & D.* Kermit D. Wade, *Ch. Chem.* W. W. Schoenfeld, *Traf. Mgr.* Refineries located at Karns City and Titusville, Pa.

Pennzoil Co., The, Oil City, Pa.
C. L. Suhr, *Chm. Bd.* W. S. Zehrung, *Pres.* M. A. Brewster, *V. P.* and *Treas.* D. W. Grant, *V. P.* R. A. Browne, *Sec.* and *Whlse. Sales Mgr.* V. Benson, *Mgr. Retl.* lubricant sales. J. G. Miller, *Mgr. Retl.* gasoline sales. L. D. Fulton, *Gen. Supt. Ref.* J. M. Hinman, Rouseville; D. J. Harvey, Oil City, *Asst. Supts.* T. J. Harkins, *Ch. Chem.* A. W. Clinger, *Pur Agt.* D. E. Carrier, *Traf. Mgr.* Refineries located at Rouseville and Oil City, Pa.

Peppers Gasoline Co., Box 86, Oklahoma City, Okla.
Charles C. Peppers, *Pres.* and *Gen. Mgr.* H. H. Champlin, *Sec.* and *Treas.* J. C. McConico, *Gen. Supt. Ref.* Refinery located at Oklahoma City, Okla.

Perry Petroleum Co., Box 1467, Denver, Colo.
F. L. Perry, *Pres., Treas.* and *Sales Mgr.* L. H. Perry, *V. P.* C. F. Russell, *Sec.* H. B. Masters, *Gen. Supt. Ref.* Refinery located at Denver, Colo.

Petco Oil Corp., Santa Maria, Calif.
E. L. Craigen, *Gen. Mgr.* Refinery located at Santa Maria, Calif.

Petrol Corp., The, 950 S. Broadway, Los Angeles, Calif.
Edwin W. Pauley, *Pres.* Harold Pauley, *V. P. chg. Sales.* Claude L. Cameron, *Asst. Sec.* and *Treas.* Jack Cummins, *Sales Mgr. Asphalt.* Capt. James Irvine, *Sales Mgr. Fuel Oil.* W. T. Christman, *Gen. Mgr. Ref.* Ray Kerr, W. C. Dunbar, Jack Walsh, *Supts.* Fred Griffith, *Ch. Chem.* Alex J. Diepenbrock, *Ch. Engr. Drlg.* and *Prod.* Frank Manz, *Pur. Agt.* J. W. Chartrand, *Traf. Mgr.* Refinery located at Los Angeles, Calif.

Petroleum Products Co., The, Chanute, Kans.
Frank Young, *Pres.* B. C. Kiplinger, *V. P.* O. H. Cunningham, *Sec., Treas.,* and *Sales Mgr.* F. G. Hooker, *Ref. Supt.* Refinery located at Chanute Kans.

Petroleum Products Refining Co., Prewitt, N. M.
Partnership composed of Ray McGlothlin, Prewitt, N. M., and Rip Underwood, Amarillo, Tex. Ray McGlothlin, *Gen. Mgr. Ref.* and *Gen. Supt.* J. J. Bledsoe, *Proc. Supt.* H. L. Kerr, *Ch. Chem.* Refinery located at Prewitt, N. M.

Petroleum Utilities Co., Inc., Chadron, Neb.
C. F. Harshfield, *Pres.* and *Sales Mgr. Whlse.* Lucille Harshfield, *V. P.* J. M. Voice, *Sec.* and *Treas.* and *Sales Mgr. Retl.* C. L. Eleson, *Gen. Supt. Ref.* Refinery located at Chadron, Neb.

Pettus Oil & Refining Co., Pettus, Tex.
Morris Roberts, *Pres.* W. D. Walton, *V. P.* George A. Ray, Jr., *Sec.* and *Treas.* D. C. Roberts, *Gen. Mgr.* T. R. Hoflus, *Supt. of Ref.* Refinery located at Pettus, Tex.

Phillips Petroleum Co., Bartlesville, Okla.
Frank Phillips, *Chm. Bd.* K. S. Adams, *Pres.* Don Emery, *V. P.* and *Gen. Counsel.* G. G. Oberfell, *V. P. Research Dept.* H. E. Koopman, *V. P. Pur. Dept.* C. P. Dimit, *V. P. Prod. Dept.* M. P. Youker, *V. P. Ref. Dept.* F. E. Rice, *V. P. Natural Gaso. Dept.* H. A. Trower, *V. P. Retirement Committee.* A. M. Hughes, *V. P. Sales Dept.* J. M. Sands, *V. P. Economics Dept.* C. R. Musgrave, *V. P. Traf. Dept.* C. O. Stark, *V. P. Land and Geol. Dept.* A. H. Riney, *V. P. Engr. Dept.* R. C. Jopling, *V. P. Pub. Relations Dept.* B. F. Stradley, *Sec.* R. M. Riggins, *Treas.* E. J. Webster, *Sales Mgr.* W. G. Hiatt, *Mgr. Ref.* E. H. Bender, *Mgr. Ref. Dept. Gen. Office.* W. H. Creel, *Ch. Ref. Engr.* J. E. Bogk, *Ch. Process Engr.* Hugh Miller, Borger; J. W. Mitchell, Kansas City; R. D. Evans, Okmulgee; E. H. Daniel, Judkins, *Ref. Supts.* R. E. Mills, Borger; H. B. Hettinger, Kansas City; P. M. Waddell, Okmulgee, *Mfg. Supts.* C. C. Tate, Borger; W. A. McCarthy, Kansas City; V. C. Cavin, Okmulgee, *Mech. Supts.* R. C. Alden, *Dir. Research.* W. A. Schulze, F. E. Frey, W. B. Lerch, *Assoc. Dirs. Research;* H. B. Heine, *Pur. Agt.* E. C. Kitching, *Traf. Mgr.* Refineries located at Borger, Tex.; Kansas City, Kans.; Okmulgee, Okla.; Penwell, Tex. (Judkins).

Phoenix Refining Co., Box 248, San Antonio, Tex.
R. R. Russell, *Pres.* D. A. Russell, *V. P.* Meta Russell, *Sec.* and *Treas.* C. L. Mullenax, Houston, *Ref. Supt.* Refineries located at Waco, Houston and San Antonio, Tex.

Pilgrim, Inc., Kingston, Okla.
Montie Blakely, *Pres.* and *Sales Mgr.* Vera Blakely, *V. P.* R. M. Massey, *Sec.* and *Treas.* Plant located at Kingston, Okla.

Pilot Oil Co., Morton, Wyo.
Alfred Ellerby, *Chm. Bd.* Leonard Smith, *Pres.* LeRoy N. French, *Sec.* E. J. Lauer, *Sales Mgr.* James T. Majors, *Gen. Mgr. Ref.* Plant located at Morton, Wyo.

Pioneer Oil & Refining Co., 604 Carolina St., San Antonio, Tex.
A. B. Slimp, *Pres.* C. A. Slimp, *V.P.* and *Pur. Agt.* S. B. Sloan, *Sec.* F. A. Slimp, *Treas.* and *Sales Mgr.* J. E. Dismukes, *Gen. Supt. Ref.* A. I. Robertson, *Ch. Chem.* C. A. Slimp, Jr., *Traf. Mgr.* Refinery located at Somerset, Tex.

Pondera Valley Refinery, Conrad, Mont.
E. F. Mote, *Owner.* Refinery located in Pondera field, Montana.

Pontiac Refining Co., 3400 Lawrence St., Corpus Christi, Tex.
Saul Singer, *Pres* and *Treas.* Edwin Singer, *Sec.* and *Pur. Agt.* Otto Geppelt, *Ref. Supt.* Refinery located at Corpus Christi, Tex.

Porter Oil Co., Sidney, Neb.
R. J. Porter, *Owner.* George P. Porter, *Sales Mgr.* John Moseman, *Gen. Supt. Ref.* Plant located at Sidney, Neb.

Post Refining Co., Box 447, Rotan, Tex.
T. E. Patton, E. N. Patton, J. H. Patton, *Owners.* Refinery located at Rotan, Tex.

Premier Oil Refining Co. of Texas, Box 1512, Longview, Tex.
J. R. Parten, *Chm. Bd.* Sylvester Dayson, *Pres.* and *Gen. Mgr. Ref.* Sam W. Ross, *V. P.* R. P. Hargis, *Sec., Treas.* and *Pur. Agt.* E. E. Jackson, *Sales Mgr.* L. G. Fufilho, *Gen. Supt. Ref.* Elmer Smith, Longview; N. Y. Jones, Cotton Valley, *Supts.* Paul W. Morgan, *Ch. Chem.* H. K. Fuller, *Traf. Mgr.* Refineries located at Longview (Willow Springs) Tex. and Cotton Valley, La.

Princeton Refining Corp., 520 First Natl. Bank Bldg., Shreveport, La.
B. H. Gray, *Pres.* and *Treas.* H. C. Geren, *V. P.* and *Gen. Supt. Ref.* Arthur N. Sample, Jr., *Sec.* K. P. Roberts, *Asst. Sec.* A. L. Brenneman, *Ch. Chem.*

YOU READ OIL—WE READ WATER

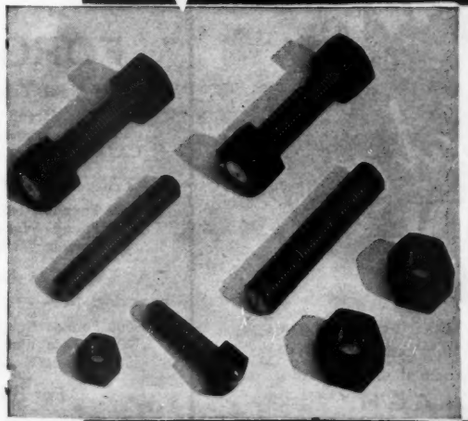
Just as you have to refine oil to get the most out of it, so you have to treat water to decrease your refining cost. You know how to refine oil. Our business is to know how to control water corrosion, scale, deposits and living organisms. We not only know what to do to decrease cost and increase efficiency by treating water, but we have the organic chemicals to correct the water. These Haering products each have a definite purpose.

Chrom Glucosates — *For Corrosion Prevention*
Sodium Glucosate — *For pH Adjustment*
Sulpho Glucosates — *For Oxygen Removal*
Quachrom Glucosate — *For Corrosion Control*
Beta Glucoside — *For Scale Prevention*
H-O-H Feeders — *For Accurate Proportioning*
Pyro Glucosate — *For High Pressure Boilers*
In-Hib-Co Coatings — *Protect Tanks, Pipes and All Exposed Surfaces*

Our laboratories in Chicago, Wichita, Kansas, and New York City, serve you overnight. Send us your water problems; or write for our house organ, "H-O-H LIGHTHOUSE."

D. W. HAERING & CO., INC.
2308 S. Winchester Ave. Chicago

VICTOR HEAT & CORROSION RESISTING BOLTS, NUTS & STUDS



For refineries, natural gasoline plants, and manufacturers of refinery and oil field equipment, VICTOR manufactures special BOLTS, NUTS, SCREWS, and STUDS, to any size and material specification.

A convenient, speedy, personalized service on all types of high strength bolting products from heat-treated alloy steels, corrosion and heat resistant alloys, non-ferrous metals and carbon steels.

VICTOR HEAT TREATED ALLOY STEEL STUDS
for high temperature, high pressure piping

Made to rigid A.S.T.M. specifications to fulfill any size and application requirements for flanged fittings and valves. VICTOR Heat-Treated Alloy Steel Studs are guaranteed for quality and satisfactory service.

Write today for the VICTOR Catalog and Prices. You just can't beat VICTOR quality!

VICTOR PRODUCTS CORP. 2649 Belmont Ave. CHICAGO, U. S. A.

K. P. Roberts, *Traf. Mgr.* Refinery located at Princeton, La.

Producers Refining, Inc., West Branch, Mich.
James P. Dunnigan, *Pres., Sales Mgr. Whsle.* and *Gen. Mgr.* D. E. Tolfree, *V. P.* M. E. Orr, *Sec.* Arthur Crawford, *Treas.* and *Pur. Agt.* R. M. Hayes, *Sales Mgr. Retl.* C. G. Miller, *Gen. Supt Ref.* H. B. Martin, *Asst. Supt.* Lou Edsall, *Ch. Chem.* John B. Hecox, *Traf. Mgr.* Refinery located at West Branch, Mich.

Production Refining Co., Shelby, Mont.
Lawrence Medford, *Supt.* Refinery located at Shelby, Mont.

Pure Oil Co., The, 35 E. Wacker Drive, Chicago, Ill.
B. G. Dawes, *Chm. Bd.* Henry M. Dawes, *Pres.* R. W. McIlvain, C. B. Watson, N. H. Weber, *V. P.s.* Rawleigh Warner, *V. P. and Treas.* L. S. Wescoat, *V. P.* and *Sec.* R. H. McElroy, Jr., *Asst. to V. P. chg. Sales.* C. W. Snider, *Sales Mgr.* J. P. Langfitt, *Asst. to V. P. chg. Ref.* C. R. Wagner, *Mgr. R. & D.* D. E. Sullivan, *Ch. Engr.* G. L. Parsons, *Pur. Agt.* Henry Hauseman, *Traf. Mgr.* J. C. Megraw, *Supt.;* D. P. Hankins, *Asst. Supt.;* W. L. Dulaney, *Foreman,* Cabin Creek. E. E. McPherson, *Supt.;* I. L. Hostetler, *Asst. Supt.;* Harry Hook, *Foreman,* Heath. E. A. McCadden, *Supt.;* J. J. Grace, *Asst. Supt.,* Marcus Hook. R. L. Vernor, *Supt.;* J. A. Allen, *Asst. Supt.;* H. H. Dronberger, *Foreman,* Smiths Bluff. R. C. Osterstrom, *Mgr.;* H. L. Smith, *Supt.;* C. D. Freshour, *Foreman, Toledo.* O. B. Wendeln, *Supt.;* D. C. Doramus, *Foreman,* Midland. Refineries located at Cabin Creek Junction, West Va.; Newark (Heath)), Ohio; Midland, Mich.; Nederland (Smiths Bluff), Tex.; Toledo, Ohio.

Purzone, Inc., 85 Thirtieth Ave., N., Minneapolis, Minn.
H. A. Ohlgren, *Pres.* and *Gen. Mgr. Ref.* C. A. West, *V. P.s.* W. R. Reitz, *Sec.* and *Treas.* G. B. Hunter, *Gen. Mgr. Ref.* E. E. Ebner, *Gen. Supt. Ref.* J. B. Northrop, St. Marys, W. Va.; W. H. Rockman, Farmers Valley, Pa.; E. E. Ebner, Emlenton, Pa., *Ref. Supts.* L. R. Forker, *Pur. Agt.* G. W. Ebert, *Traf. Mgr.* Refineries located in Pennsylvania and West Virginia.

Q

Quaker State Oil Refining Corp., Oil City, Pa.
H. J. Crawford, *Pres.* James D. Berry, S. Messer, *V. P.s.* W. R. Reitz, *Sec.* and *Treas.* G. B. Hunter, *Gen. Mgr. Ref.* E. E. Ebner, *Gen. Supt. Ref.* J. B. Northrop, St. Marys, W. Va.; W. H. Rockman, Farmers Valley, Pa.; E. E. Ebner, Emlenton, Pa., *Ref. Supts.* L. R. Forker, *Pur. Agt.* G. W. Ebert, *Traf. Mgr.* Refineries located in Pennsylvania and West Virginia.

R

Rado Refining Co., McAllen, Tex.
Charles J. Holland, *Pres.* Ralph E. Fair, *V. P.* Clyde Aylesworth, *Sec.* and *Sales Mgr.* J. F. Ewers, *Treas.* Jack Harding, *Ref. Supt.* Refinery located at McAllen, Tex.

Ralston Refinery, Upton, Wyo.
Mrs. J. F. Ralston, *Pres.* Refinery located at Upton, Wyo.

Raven Oil & Refining Co., Box 142, Vernal, Utah.
George D. Merkley, *Pres.* Wm. H. Siddoway, *V.P.* R. A. Bryson, *Sec., Treas.* and *Sales Mgr.* M. M. Cook, *Ref. Supt.* Refinery located at Rangely, Colo.

Republic Oil & Refining Co., Benedum-Trees Bldg., Pittsburgh, Pa.
O. D. Robinson, *Pres.* D. W. Hovey, *V. P.* and *Gen. Mgr.* J. M. Gardiner, W. E. Huston, *V. P.s.* W. H. Moreland, *Sec.* and *Treas.* C. E. Robertson, *Ref. Supt.* C. C. Evans, *Asst. Supt.* D. M. Veale, *Ch. Chem.* L. Keller, *Ch. Engr.* R. H. Armstrong, *Pur. Agt.* Refinery located at Texas City, Tex.

Resolute Oil Corp., 504 Strain Bldg., Great Falls, Mont.
Julius C. Peters, *Pres.* Russell Strain, *V. P.* C. A. Harper, *Sec.* and *Sales Mgr.* Arthur Strain, *Treas.* B. J. Manley, *Gen. Mgr. Ref.* Verne E. Schwin, *Traf. Mgr.* Refinery located at Badger Basin, Wyo.

Rex Oil Refinery, Rapid City, S. D.
Gail M. Lewis, *Mgr.* E. E. Ratliff, *Ref. Supt.* C. F. Clark, *Mgr. R. & D.* Refinery located at Rapid City, S. D.

Rice Ranch Oil Co., 124 W. Fourth St., Los Angeles, Calif.
J. C. Netz, *Pres.* George W. Lichtenberger, *V. P.* I. M. Hine, *Sec.* Byron J. Billington, *Ch. Engr.* and *Supt.* Refinery located at Santa Maria, Calif.

Richfield Oil Corp., 555 S. Flower St., Los Angeles, Calif.
H. F. Sinclair, *Chm. Bd.* W. Alton Jones, *Chm. Finance Comm.* Charles S. Jones, *Pres.* W. T. Dinkins, A. M. Kelley, F. A. Morgan, *V. P.s.* M. Richard Gross, *Treas.* W. T. Autrey, *Comptroller.* Cleve B. Bonner, *Sec.* E. B. Downey, *Asst. Treas.* and *Asst. Sec.* Leonard Switzer, *Asst. Sec.* C. R. McKay, *Gen. Mgr. Ref.* R. A. Panero, *Watson* and *Rioco, Calif.;* William Murray, *Vinvale, Calif., Ref. Supts.* W. R. Davis, *Watson;* O. C. Smith, *Rioco Asst. Supts.* C. K. Hewes, *Ch. Chem.* Frank J. Fontana, *Ch. Engr.* H. H. Kelly, *Pur. Agt.* Refineries located at Watson (near Wilmington); Hynes (Long Beach), and Vinvale (South Gate), Calif.

Rock Island Refining Co., Duncan, Okla.
L. B. Simmons, *Pres.* L. E. Kincannon, H. B. Alspaugh, O. W. Simmons, *V. P.s.* H. C. Allen, *V. P.* and *Sales Mgr.* W. Witt, *Sec.* and *Treas.* A. L. Rayburn, *Ref. Supt.* Dale A. Fischbeck, *Ch. Chem.* W. D. Manz, *Ch. Engr.* R. H. Roper, *Pur. Agt.* and *Traf. Mgr.* Refinery located at Beckett, Okla.

Rock Island Refining Corp., Duncan, Okla.
L. B. Simmons, *Pres.* L. E. Winkler, Wichita, Kans., *V. P.* L. E. Kincannon, *V. P.* and *Sec.* Constructing refinery near Indianapolis, Ind.

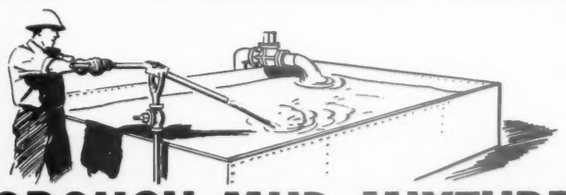
Rodessa Oil & Refining Corp., 301 First Natl. Bank Bldg., Shreveport, La.
Refinery located at Cedar Grove, La.

Root Petroleum Co., Commercial Natl. Bank Bldg., Shreveport, La.
D. P. Hamilton, *Pres.* H. Canon, *V. P.* D. A. Brown, *V. P. chg. Sales.* T. E. Beaird, *Sec.* and *Pur. Agt.* D. P. Hamilton, *Gen. Mgr. Ref.* Ed Kimes, *Gen. Supt. Ref.* John Brown, *Asst. Supt.* R. T. Colquette, *Mgr. R. & D.* R. L. Aycock, *Traf. Mgr.* Refinery located at El Dorado, Ark.

Roosevelt Oil Co., Box 271, Mount Pleasant, Mich.
C. L. Maguire, *Pres.* W. L. Davis, *V. P.* S. M. Fasquelle, *Sec.* and *Treas.* Arthur W. Winter, *Sales Mgr. Whsle.* C. L. Butler, *Sales Mgr. Retl.* D. Y. Hewitt, *Gen. Mgr. Ref.* Don J. Baize, *Gen. Supt. Ref.* Leon Martin, *Asst. Supt.* Earl Martin, *Ch. Chem.* D. L. Conkright, *Pur. Agt.* B. E. Kothe, *Traf. Mgr.* Refinery located at Mount Pleasant, Mich.

Roper Petroleum Co., Parsons, Kans.
E. E. Roper, *Mgr. Ref.* and *Pur. Agt.* H. E. Roper, *Asst. Mgr.* and *Pur. Agt.* R. H. Hall, *Gen. Supt.* Refinery located at Parsons, Kans.

Rothschild Oil Co., Santa Fe Springs, Calif.
Harry S. Rothschild, *Pres.* Oscar Samuelson, *V. P.* Josephine E. Rothschild, *Sec.* and *Treas.* L. A.



A THOROUGH MUD MIXTURE

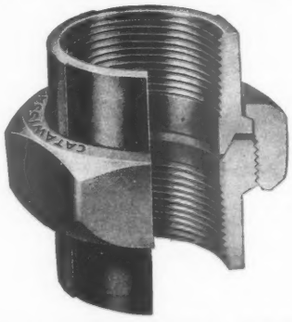
PATTERSON-BALLAGH
Super Universal
MUD GUN

Keep your rotary mud from settling and separating. With this advanced gun, your conditioned mud does not deteriorate. Double balanced flow. Will not spin. Universal position with lock. Rubber nozzles available. Get details.

PATTERSON-BALLAGH CORPORATION
Los Angeles Houston New York City

PATTERSON-BALLAGH PRODUCTS
PROTECTORS - STABILIZERS - MUD GUNS - PIPE & WIRE LINE WIPERS - WIRE LINE GUIDES

CATAWISSA



FORGED STEEL UNIONS

Are the Best You Can Buy for Efficient and Economical Service.

They are forged from solid steel bars, machined, hand ground and tested under close inspection. No matter what your Union Requirements, there is a CATAWISSA UNION which will give complete satisfaction.

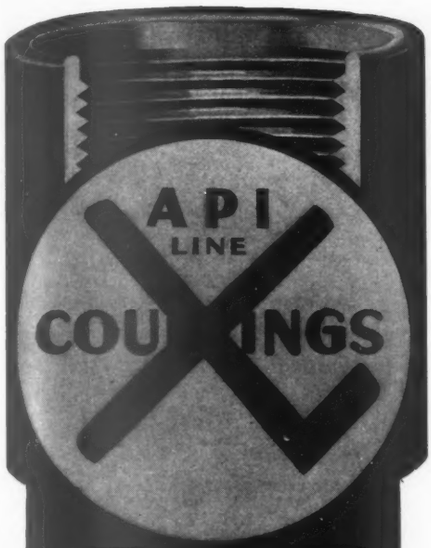
CATAWISSA STANDARD UNIONS Are Recommended For—
2000 Pounds Nonshock Pressure, Air, Oil, Water or Gas to 150° F.
700 Pounds Working Pressure, Steam, Hot Oil, Vapor to 500° F.
600 Pounds Working Pressure, Steam, Hot Oil, Vapor to 750° F.

CATAWISSA DOUBLE EXTRA HEAVY UNIONS Are Recommended For—
6000 Pounds Nonshock Pressure, Air, Oil, Water or Gas to 150° F.
1500 Pounds Working Pressure, Steam, Hot Oil, Vapor to 750° F.
900 Pounds Working Pressure, Steam, Hot Oil, Vapor to 1000° F.

For Special Requirements Write For Bulletin.

THE CENTRAL FORGING CO.
CATAWISSA, PA.

DISTRIBUTORS IN ALL OIL FIELDS



Any leading oil field distributor will tell you about the superiority of "X-L" Couplings. Our special patented process for recessing means concentricity of recess in combination with threaded section of couplings, assuring accuracy in alignment of joints. Microscopically tested to assure A.P.I. standards.

Warehoused by

HENRY H. PARIS, 1121 Rothwell St., Houston

JAMES RIORDAN CO., Los Angeles, San Francisco

WHEELING MACHINE PRODUCTS COMPANY
WHEELING, W.VA.

ESPECIALLY RECOMMENDED FOR USE IN THE

COPPER SWEETENING PROCESS

Nichols

TRIANGLE BRAND

COPPER SULPHATE

is preferred by leading refineries because of its high copper content, dependable uniformity and exceptional purity and freedom from foreign and inert matter.

99%+ PURE

Quotation on request, on any quantity required. Prompt shipments can be made from our nearest plant.

PHELPS DODGE REFINING CORP.
40 WALL STREET, NEW YORK
230 N. MICH. AVE., CHICAGO

Whitlock, *Supt.* Refinery located at Santa Fe Springs, Calif.

Rusk Oil & Refining Co., Peoples Bank Bldg., Tyler, Tex.
H. H. Coffield, *Pres.* George P. Mann, *V. P.* J. H. Edwards, *Sec.* Refinery located at Overton, Tex.

Russell Oil Co., 642 Utah Ave., Butte, Mont.
Mrs. Joseph Russell, *Pres.* Ludwig Renland, *Sec.* Plants located at Billings and Butte, Mont. (Leased by Independent Refining Co.)

Russell Oil Co., San Antonio, Tex.
Louis M. Carle, *Pres.* Joseph Mooney, *V. P.* A. J. Cryer, *Gen. Supt.* Refinery located at San Antonio, Tex.

Russell Producing Co., The, Sunbright, Tenn.
John J. Rowe, *Pres.* W. R. Foulkes, *V. P.* Frank H. Blum, *Sec.* and *Treas.* R. L. Mong, *Gen. Supt. Ref.* Refinery located at Sunbright, Tenn.

S

Salt Creek Refinery, Casper, Wyo.
Refinery located at Columbine, Wyo.

San Fernando Refining Co., Box 310, San Fernando, Calif.
J. O. Moffett, *Sales Mgr.* Wm. D. Parks, *Gen. Mgr. Ref.* Ira D. Parton, Don Conklin, *Asst. Supts.* E. A. Ericson, *Pur. Agt.* Refinery located at Newhall, Calif.

Sandgren & Nyhagen Refinery, Cut Bank, Mont.
R. S. Nyhagen, *Owner* and *Operator.* Plant located at Cut Bank, Mont.

San Juan Oil & Refining Co., Farmington, N. M.
Refinery located at Farmington, N. M.

Seaboard Refining Co., Piscataway, N. J.
Allen H. Clark, 80 Broad St., New York, N. Y., *Treas.* George Benhoff, *Gen. Supt.* Refinery located at Piscataway, N. J.

Searle Petroleum Co., Omaha, Neb.
H. A. Searle, Jr., *Pres.* and *Pur. Agt.* W. B. Cessna, *V. P.* C. L. Clarke, *Sec.* H. C. Smith, *Treas.* H. C. Linenkol, *Gen. Supt.* H. A. Searle, III, *Ch. Chem.* Refinery located at Omaha, Neb.

Seaside Oil Co., 330 State St., Santa Barbara, Calif.
M. W. O'Brien, *Pres.* and *Gen. Mgr.* H. B. Kellogg, *V.P.* G. C. Howell, *Sec.* H. L. Harms, *Treas.* F. E. McClaren, *Sales Mgr.* L. C. McCampbell, *Acting Supt.* B. F. Fuller, D. E. Sarles, *Asst. Supts.* C. C. Putman, *Ch. Engr.* C. W. Chamberlain, *Pur. Agt.* Refineries located at Summerland and Ventura, Calif.

Shale Oil Co., Route 1, Lawton, Okla.
J. P. Summitt, *Owner.* Refinery located at Lawton, Okla.

Shallow Water Refining Co., The, 310½ N. Main, Garden City, Kans.
Morten Brown, *Pres.* J. B. Allison, *V. P.* D. M. Dryden, *Sec.* and *Sales Mgr.* C. L. Crenshaw, *Treas.* and *Gen. Mgr. Ref.* V. F. Benest, *Ref. Supt.* A. R. Greene, *Ch. Chem.* K. White, *Traf. Mgr.* Refinery located at Shallow Water, Kans.

Shamrock Oil & Gas Corp., The, Sunray, Tex.
W. C. Fownes, Jr., *Chm. Bd.* H. C. Fownes II, *Pres.* J. H. Dunn, *V. P.* and *Gen. Mgr. Ref.* Ray Johnson, *Sec.* L. J. Wilmeth, *Sales Mgr.* P. C. Coffin, *Gen. Supt. Ref.* R. G. Atkinson, *Ref. Supt.* R. W. Koerting, *Asst. Supt.* H. V. Cook, R. W. Koerting, C. A. Cash, *Process. Supts.* F. H. Stone, *Ch. Engr.* J. R. Boone, *Pur. Agt.* Refinery located at Sunray, Tex.

Shell Oil Co., Inc., 50 W. 50th St., New York, N. Y.
S. Belither, Alexander Fraser, A. J. Galloway, F. A. C. Guepin, D. Heggie, *Directors.* S. Belither, *Chm. Bd.* and *Exec. V. P.* Alexander Fraser, *Pres.* F. A. C. Guepin, *Senior V. P.* east of Rockies. H. H. Anderson, *V. P.* east of Rockies. F. S. Clulow (San Francisco), *V. P. Mfg.*, Pacific Coast. E. D. Cumming (New York City), *V. P. Mfg.*, east of Rockies. E. F. Davis, *V. P.* Los Angeles area of Pacific Coast. A. J. Galloway, *V. P.* east of Rockies. R. R. Griffin, *V. P. Marine Trans.* D. Heggie, *V. P.* Pacific Coast. L. T. Kittinger, *V. P. Sales*, east of Rockies. P. E. Lakin, *V. P.* Chicago. N. J. McGaw, *V. P. Trans. and Supplies*, east of Rockies. L. G. McLaren, *V. P. Sales*, Pacific Coast. Charles E. Mott, *V. P.*, Pacific Coast. R. B. Roark, *V. P.*, Tulsa area east of Rockies. J. W. Watson, *Treas.* C. S. Gentry, *Sec.* A. R. Bradley, *Asst. Sec.* Joe T. Dickerson, George W. Cunningham, *Asst. Secs.*, east of Rockies. B. D. Koontz, *Asst. Sec.*, Pacific Coast. E. C. Peet, *Asst. Sec.* and *Asst. Treas.*, east of Rockies. W. A. Baker, J. M. Flaherty, J. H. White, *Asst. Treas.*, east of Rockies. C. B. Singleton, *Pur. Agt.* R. C. Roberts, *Ref. Mgr.;* H. D. Dale, *Ref. Supt.*, Wood River, Ill. P. E. Foster, *Ref. Mgr.;* P. E. Hurley, *Ref. Supt.*, Norco, La. R. H. Waser, *Ref. Mgr.;* J. L. Miller, *Ref. Supt.*, Houston, Tex. I. M. Hemphill, Wilmington, Calif.; A. H. Calderwood, Martinez, Calif.; A. E. Meyers, Coalinga, Calif., *Ref. Mgrs.*

RYERSON CERTIFIED STEELS

LARGE STOCKS...IMMEDIATE SHIPMENT

Principal products include—Alloy Steels, Tool Steels, Stainless Steel, Hot Rolled Bars, Hoops and Bands, Beams and Heavy Structurals, Channels, Angles, Tees and Zees, Plates, Sheets, Cold Finished Shafting and Screw Stock, Strip Steel, Flat Wire, Boiler Tubes, Mechanical Tubing, Rivets, Bolts, etc. Write for Stock List. Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

New 90-UL **ECOLITE** *Safety* **LANTERN**

THROWS 1500 FOOT BEAM

LIGHTS Your Way With SAFETY

Only Ecolite 90-UL Gives You All These Advantages

ALZAC PLATED ALUMINUM REFLECTOR—Develops large volume of light. Lantern throws piercing beam 1500 feet.

SAFE IN HAZARDOUS LOCATIONS—Tested and recommended by Underwriters' Laboratories.

ADJUSTABLE BULB SOCKET maintains proper focal point between bulb and reflector.

SEALED BEAM CONSTRUCTION—Entire reflector screws off to allow changing bulb without removing lens or lens ring. Protects reflector surface from outside contact.

PIVOT BASE—Can direct light to any location. Permits rotation of light in 360° circle and leaves hands free for work.

POLISHED MIRROR CHROME finish on cover and reflector housing.

SELF ADJUSTING HANDLE turns to any desirable carrying position and remains fixed.

Trouble-free sliding switch, safety broken bulb ejector, and other safety features make Ecolite 90-UL the ideal lantern for hazardous locations. Now available at Jobber and Supply Stores.

ECONOMY ELECTRIC LANTERN CO.
3100 W. CHERRY ST. MILWAUKEE, WIS.
Pacific Coast Office:
1818 S. Grand Avenue, Los Angeles, Calif.

Refineries located at Wood River, Ill.; Norco, La: Houston, Tex.; Wilmington, Martinez, and Coalinga (Oil Fields), Calif.

Shelly Refining Co., Box 1191, Bay City, Tex.

F. E. Shelly, *Pres.* R. D. Williams, *V. P.* and *Gen. Mgr. Ref.* J. A. Shelly, *Sec.* C. R. Black, *Sales Mgr.* R. C. Rohrdanz, *Gen. Supt. Ref.* and *Pur. Agt.* Refinery located at Bay City, Tex.

Sherwood Petroleum Co., Inc., Englewood, N. J.

H. H. Sherwood, *Pres.* A. J. Glacel, *V.P.* James W. Jackson, *Sec.* G. D'Amore, *Treas.* and *Pur. Agt.* A. F. H. Payne, *Sales Mgr.* R. Parker, *Gen. Supt. Ref.*; A. J. Franks, *Gen. Mgr. Rer.*; C. J. McManus, *Asst. Supt.*, Warren, Pa. D. Marsh, *Ch. Chem.* C. B. Montalto, *Traf. Mgr.* Refinery located at Warren, Pa.

Shoreline Oil Co., P. O. Box 103, Shreveport, La.

C. M. Leonard, *Pres.* R. C. Burdick, *V. P.* Refinery located at Shoreline, La.

Signal Hill Refining Co., 2800 Cherry Ave., Long Beach, Calif.

M. M. McCallen, H. H. McVicer, C. M. Road, *partners.* R. Hildebrand, *Gen. Mgr. Ref.* Refinery located at Long Beach, Calif.

Silver Tip Refinery, Yoder, Wyo.

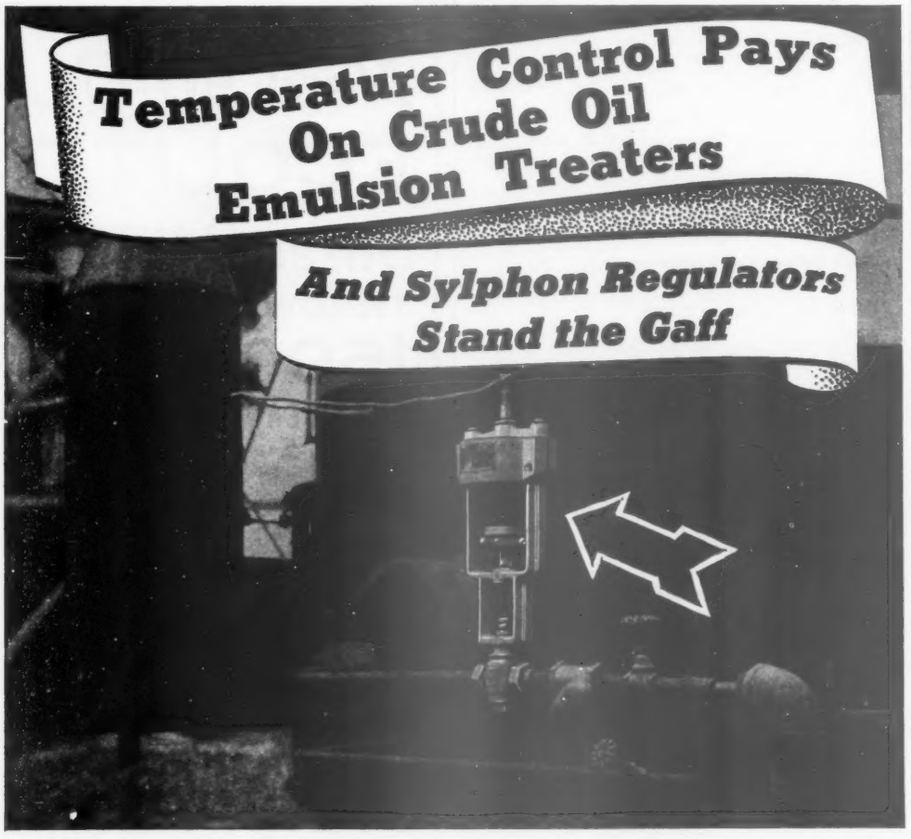
Albert P. Bruch, *Sales Mgr.* and *Pur. Agt.* Harry Watson, *Supt.* Plant located at Yoder, Wyo.

Silver Wing Refining Co., Santa Maria, Calif.

B. A. Coates, *Trustee.* Refinery located at Santa Maria, Calif.

Sinclair Refining Co., Inc., 630 Fifth Ave., New York, N. Y.

E. W. Sinclair, *Pres.* J. W. Carnes, *V. P.* and *Sales Mgr.* M. L. Gosney, *V. P., Sec.,* and *Treas.* George H. Taber, Jr., *V. P.* and *Gen. Mgr. Ref.* Edward H. Chandler, Sheldon Clark, E. W. Isom, C. H. Kountz, J. R. Manion, J. M. O'Day, K. Porter, L. V. Stanford, J. G. Johnson, *V. P.s.* George R. Lord, *Gen. Supt. Ref.* E. B. Phillips, *Ch. Chem.* J. S. Hess, *Ch. Engr.* H. B. Malone, *Pur. Agt.* J. M. O'Day, *Traf. Mgr.* Refineries located at East Chicago, Ind.; Kansas City and Coffeyville, Kans.; Wellsville, N. Y.; Sand Springs, Okla.; Marcus Hook, Pa.; Fort Worth and Houston, Tex.; Parco, Wyo.



Don't risk damage from overheating. Stop sludge formation. Keep oil temperature exactly at the emulsion breakdown point with simple, rugged, self-operating Sylphon Regulators—built especially for this service.

FULTON Sylphon FOR TEMPERATURE CONTROL

Strongly constructed Stainless Steel Trimmed Valve. Corrosion-resistant stainless steel bulb. Armored connecting tubing. Regulator has a wide range of temperature adjustment.

Recommended by leading Oil Treating Equipment Manufacturers. Write for Bulletin FJ-20.

THE FULTON SYLPHON CO.
KNOXVILLE, TENNESSEE
Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England

Skelly Oil Co., Skelly Bldg., Tulsa, Okla.

W. G. Skelly, *Pres.* C. C. Herndon, *Exec. V. P.* H. M. Stalcup, *V. P. chg. Prod.* J. D. Powell, *V. P. chg. Mktg.* Arch H. Hyden, *V. P.* J. F. Nagle, *Exec. Asst.* F. T. Hopp, *Sec.* and *Treas.* E. F. Underwood, *Sales Mgr. Whsle.* Jess Knowles, *Sales Mgr. Retl.* K. J. Smith, *Gen. Mgr. Ref.* A. G. Schuessler, C. E. Gore, *Asst. Supts.* R. W. Leslie, *Mgr. R.* and *D.* E. A. Todd, *Ch. Chem.* L. E. Weber, *Ch. Engr.* F. W. Robertson, *Pur. Agt.* A. F. Winn, *Traf. Mgr.* Refinery located at El Dorado, Kans.

Socal Oil & Refining Co., 1004 Rowan Bldg., Los Angeles, Calif.

C. A. Johnson, *Pres.* J. H. Grimes, Huntington Beach, *V. P.* and *Gen. Supt.* Paul Fussell, *Sec.* W. E. Lanzer, *Sales Mgr.* P. J. Hallicy, *Treas.*; E. T. Carlton, *Asst. Treas,* Box 430, Huntington Beach. Refinery located at Huntington Beach, Calif.

Socony-Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.

J. A. Brown, *Pres.* C. E. Arnott, E. R. Brown, A. F. Corwin, G. V. Holton, H. F. Sheets, *V. P.s.* W. D. Bickham, *Sec.* A. T. Roberts, *Treas.* W. F. Burt, *Chm. Mfg. Committee.* W. L. Linton, *Supt.*; F. W. Hadley, *Asst. Supt.*, Brooklyn, N. Y. R. B. Malone, *Supt.*; Campbell Allen, *Asst. Supt.*; Long Island City N. Y. R. T. Lockwood, *Supt.*; T. M. Berry, *Asst. Supt.*, Buffalo, N. Y. C. W. Shaeffer, *Supt.*; B. Hicks, *Asst. Supt.*, Providence, R. I. J. F. Turner, *Supt.*; W. E. Wanner, *Asst. Supt.*, Olean, N. Y. D. L. Hooker, *Supt.*; H. W. Sheldon, *Asst. Supt.*, Paulsboro, N. J. E. T. Pummil, Casper, Wyo.; J. W. Glass, Augusta, Kans., *Supts.* D. A. Windsor, *Supt.*; J. B. Hickey, *Asst. Supt.*, East St. Louis, Ill. William Hildebrandt, *Supt.*; W. W. Reed, *Asst. Supt.*, East Chicago, Ind. J. B. Edwards, *Supt.*; S. W. Keller, *Asst. Supt.*, Trenton, Mich. J. B. Rather, *Mgr. R. & D.* A. E. Esser, *Ch. Engr.* J. R. Taylor, *Pur. Agt.* L. H. Benner, *Traf. Mgr.* Refineries located at Brooklyn, Long Island City, Olean, and Buffalo, N. Y.; Riverside, R. I.; Paulsboro, N. J.; East Chicago, Ind.; Trenton (White Star Div.), Mich.; East St. Louis (Lubrite Div.), Ill.; White Eagle Division, Casper, Wyo., and Augusta, Kans.

Socony-Vacuum Oil Co., Inc. (White Eagle Division), Federal Reserve Bank Bldg., Kansas City, Mo.

R. D. Mering, *Sales Mgr.* R. R. Irwin, *Gen. Mgr. Ref.* J. W. Glass, Augusta, Kans.; E. T. Pummill, Casper, Wyo., *Supts.* Emory M. Skinner, *Ch. Engr.* W. C. Etzbach, *Pur. Agt.* H. L. McReynolds, *Traf. Mgr.* Refineries located at Augusta, Kans., and Casper, Wyo.

Socony-Vacuum Oil Co., Inc., Lubrite Division, 4140 Lindell Blvd., St. Louis, Mo.

H. T. Ashton, *Gen. Mgr.* W. H. Ware, *Sales Mgr.* D. A. Windsor, *Gen. Supt.* J. B. Hickey, *Supt.* A. J. Kirwin, *Asst. Supt.* L. T. Doiron, *Ch. Chem.* R. A. Frevert, *Ch. Engr.* A. H. Dicks, *Pur. Agt.* O. E. Juster, *Traf. Mgr.* Refinery located at East St. Louis, Ill.

Solvents Refining Co., Vinvale, Calif.

George W. Rawlins, *Pres.* Carl Johnson, *Gen. Mgr.* Refinery located at Vinvale, Calif.

South Kentucky Pipe Line Co., Somerset, Ky.

R. C. Snyder, *Pres.* H. B. Wood, *V. P.* Earl R. Tate, *Sec., Treas.* and *Sales Mgr.* Dexter Parmley, *Gen. Supt. Ref.* Earl R. Tate, *Pur. Agt.* Refinery located at Somerset, Ky.

Southland Refining Co., Olney, Tex.

Refinery located at Olney, Tex.

Southport Petroleum Co. of Delaware, 1417 Commerce Bldg., Houston, Tex.

Cornelius Kroll, *Pres.* C. W. Murchison, Toddie Lee Wayne, *V. P.s.* Verne H. Maxwell, *Sec.* D. R. Zachry, *Treas.* C. F. Watson, *Sales Mgr.* J. C. Hinds, *Gen. Ref. Supt.* Refinery located at Texas City, Tex.

Southwestern Oil & Refining Co., Port & Summers Sts., Corpus Christi, Tex.

S. S. Seltzer, *Pres.* F. R. Sylvestre, *V.P.* S. S. Seltzer, Jr., *Sales Mgr., Sec.* and *Treas.* W. B. Pickrell, *Vice Sec.* G. W. Stephenson, *Gen. Supt. Ref.* C. E. Taylor, *Supt. of Operations.* W. N. Hicks, *Ch. Chem.* Refinery located at Corpus Christi, Tex.

Southwest Oil & Refining Co., Box 126, Artesia, N. M.

Chet L. Tallmadge, *Gen. Mgr.* E. M. Perry, *Auditor.* Refinery located at Artesia, N. M.

Sovereign Refining Co., 777 N. Washington Ave., Saginaw, Mich.

Will J. Sovereign, *Pres.* John S. Clark, *Sec.* Florence L. Sovereign, *Treas.* J. Lempke, *Sales Mgr.* Refinery located at Saginaw, Mich.

Standard Oil Co. of California, 225 Bush St., San Francisco, Calif.

H. D. Collier, *Pres.* R. K. Davies, R. S. Russell, J. H. Tuttle, *V. P.s.* B. W. Letcher, *Sec.* G. J. O'Brien, *Treas.* A. K. Stevenson, *Asst. Sec.* Re-

fineries located at Richmond, El Segundo and Seguro, Calif.

Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago, Ill.

Edward G. Seubert, *Pres.* Charles J. Barkdull, *Exec. V.P.* Amos Ball, *V.P. chg. Sales.* A. W. Peake, *V.P. chg. Prod.* Max G. Paulus, *V.P. chg. Mfg.* Allan Jackson, *V.P.* Felix T. Graham, *Sec.* Ralph E. Clarke, *Treas.* Conger Reynolds, *Dir. Public Relations.* R. F. McConnell, *Gen. Sales Mgr.* Harry F. Glair, *Gen. Mgr. Ref.* J. F. Hewson, *Mgr. of Pur.* Lee R. Cowles, *Traf. Mgr.* Bruce K. Brown, *Mgr. R. & D.* J. C. Marshall, *Mgr. Gasoline & Refined Oil Sales.* E. W. Miles, *Mgr. Asphalt & Fuel Oil Sales.* H. J. Saladin, *Mgr. Lubricant Sales.* J. E. Rouse, O. E. Bransky. *Asst. Gen. Mgrs. Ref.* E. J. Shaeffer, *Ref. Mgr.* F. D. Rexwinkle, *Supt.*, Whiting, Ind. S. A. Montgomery, *Ref. Mgr.*; W. J. McGill, *Supt.*, Wood River, Ill. R. E. Beard, *Ref. Mgr.*; H. R. Boehmer, *Supt.*, Sugar Creek, Mo. H. R. Snow, *Ref. Mgr.*; E. A. Metcalf, *Supt.*, Neodesha, Kans. C. C. Buchler, *Ref. Mgr. Rocky Mountain Div.* H. E. Cotton, Casper, Wyo.; B. L. Warren, Greybull, Wyo., *Supts.* Refineries located at Whiting, Ind.; Wood River, Ill.; Sugar Creek, Mo.; Neodesha, Kans.; Casper, Wyo.; Greybull, Mont.

Standard Oil Co. of Louisiana, 2134 St. Charles Ave., New Orleans, La.

M. J. Rathbone, *Pres.* S. W. Day, T. M. Milling, J. E. Skehan, *V.P.s.* M. W. Boyer, *V.P.* and *Gen. Mgr. Ref.* S. E. Kidd, *Sec.* and *Treas.* R. J. Stone, *Gen. Supt. Ref.* L. V. Robbins, *Asst. Process Supt.* C. L. Brown, Mgr. *R. & D.* M. B. Amis, *Ch. Chem.* A. F. Fritchle, *Ch. Engr.* W. N. Cottrell, *Pur. Agt.* Harry Graham, *Traf. Mgr.* Refinery located at Baton Rouge, La.

Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y.

Chester F. Smith, *Pres.* R. T. Haslam, *V. P. chg. Sales.* B. B. Howard, *V. P.* and *Marine Mgr.* E. A. Holbein, E. S. Hall, *V. P.s.* M. H. Eames, *Sec.* Jay E. Crane, *Treas.* J. R. Carringer, *Gen. Mgr. Ref.* G. H. Mettam, *Asst. Gen. Mgr. Ref.* and *Mgr.* New Jersey Works. M. R. Meacham, *Ref. Mgr.* Baltimore and Charleston. D. L. Ferguson, Linden; W. F. Thiede, Bayonne; J. F. Ewing, Baltimore; C. A. Brown, Charleston, *Supts.* R. P. Russell, *Mgr. R. & D.*; G. H. B. Davis, *Ch. Chem.*; E. H. Barlow, *Ch. Engr.*, Standard Oil Development Co. J. W. Casterton, *Pur. Agt.* A. G. Phelps, *Traf. Mgr.* Refineries located at Bayonne, Linden, and Jersey City (New Jersey Works), N. J.; Baltimore, Md., and Charleston, S. C.

Standard Oil Co. (Ohio Corp.), The, Midland Bldg., Cleveland, Ohio.

W. T. Holliday, *Pres.* A. A. Stambaugh, *V. P. chg. Sales.* W. J. Semple, *V. P.* and *Sec.-Treas.* G. W. Hanneken, *V. P. chg. Ref.* A. M. Maxwell, *V. P.* C. H. Metz, No. 1 Wks., Cleveland; L. B. Heim, No. 2 Wks., Cleveland; F. J. Sanders, Toledo; J. R. Cuthbert, Lima; A. H. Buchanan, Latonia, *Ref. Supts.* I. L. Petersen, No. 1 Wks., Cleveland; R. H. Laird, No. 2 Wks., Cleveland; W. K. Bergen, Toledo; M. G. Ball, Lima; S. R. Bolles, Latonia, *Asst. Supts.* Dr. R. E. Burke, *Mgr. R. and D.* H. P. Ferguson, *Ch. Chem.* H. F. West, *Ch. Engr.* F. W. Engle, *Pur. Agt.* E. C. Robinson, *Traf. Mgr.* Refineries located at Cleveland, Ohio; Toledo, Ohio; Lima, Ohio; Latonia, Ky.

Standard Oil Co. of Texas, 225 Bush St., San Francisco, Calif.

H. D. Collier, *Pres.* R. K. Davies, A. S. Russell, J. H. Tuttle, *V. P.s.* B. W. Letcher, *Sec.* A. K. Stevenson, *Asst. Sec.* G. J. O'Brien, *Treas.* Refinery located at El Paso, Tex.

Stanolind Oil & Gas Co., Philcade Bldg., Tulsa, Okla.

A. W. Peake, *Chm. Bd.* F. O. Prior, *Pres.* E. F. Bullard, A. M. McCorkle, *V. P.s.* F. J. Keleher, *Sec., Treas.* and *Sales Mgr.* P. G. Weidner, *Supt. Ref.* O. W. White, Superior, La., *Ref. Supt.* James Means, *Asst. Supt.* E. J. Yocom, *Ch. Chem.* W. L. James, *Pur. Agt.* J. M. Tindall, *Traf. Mgr.* Refinery located at Superior (Vivian), La.

Star Light Refining Co., Ballinger, Tex.

Art Tucker, *Pres.* Roy Duke, *Sec.* and *Treas.* O. P. Williams, *Gen. Mgr.* Refinery located at Ballinger, Tex.

Steiner, Walter, Refining Co., Box 155, Hynes, Calif.

Walter H. Steiner, *Pres.* Adelaide Steiner, *Sec.* and *Treas.* Refinery located at Long Beach, Calif.

Stephens Refining Co., Inc., Box 35, Stephens, Ark.

W. B. Hassett, *Pres.* W. L. Hassett, R. H. Hassett, *V. P.s.* L. E. Smart, *Sec.* R. H. Hassett, *Treas.* and *Gen. Mgr. Ref.* Refinery located at Stephens, Ark.

Stockton Oil Co., Stockton, Calif.

Refinery located at Stockton, Calif.

Stockton Refinery, Box 84, Stockton, Kans.

LeRoy Standley, *Owner.* Refinery at Stockton, Kans.

Stoll Oil Refining Co., 227 W. Main, Louisville, Ky.

C. C. Stoll, *Pres.* George Stoll, *V.P. chg. Sales.* Berry V. Stoll, *V.P. chg. Ref.* C. E. Stoll, *V.P. chg. Branches* and *Sec.* William A. Stoll, *V.P.* and *Treas.* John J. Kirchner, *Sales Mgr. Whsle.* J. W. Kittner, *Gen. Supt. Ref.* Covington Arterburn, *Ref. Supt.* Clem S. Luce, *Ch. Chem.* John D. Crowdus, *Pur. Agt.* Refinery located at Louisville, Ky.

Stone Oil Co., 1538 Commerce Bldg., Houston, Tex.

R. W. Stone, *Pres.* Adelaide LaCombe, *Sec.* and *Treas.* Roy H. Lindsey, *Sales Mgr.* H. M. Stone, *V. P.* and *Gen. Mgr. Ref.*; E. A. Johnson, *Gen. Supt.*; W. A. Maddox, *Asst. Supt.*; Oran Johnson, *Ch. Chem.*, Texas City. Refinery located at Texas City, Tex.

Sturgis Refining Co., Sturgis, S. D.

Charles Brodsky, *Pres.* and *Sales Mgr.* Ralph E. Williams, *Treas.* H. J. Brodsky, *Ch. Chem.* Leo Kranz, *Supt.* Refinery located at Sturgis, S. D.

Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.

J. Howard Pew, *Chm. Bd.* and *Pres.* J. N. Pew, Jr., J. Edgar Pew, A. E. Pew, Jr., S. B. Eckert, *V. P.s.* Frank Cross, *Sec.-Treas.* W. C. Pew, *Sales Mgr.* W. D. Mason, Marcus Hook; H. O. Cameron, Toledo; C. B. Carter, Yale, *Ref. Supts.* J. B. Hill, *Mgr R. & D.* C. H. Thayer, *Ch. Engr.* H. Thomas, *Pur. Agt.* P. L. Howard, *Traf. Mgr.* Refineries located at Marcus Hook, Pa.; Toledo, Ohio; Yale, Okla.

Sunray Oil Co., Phillower Bldg., Tulsa, Okla.

C. H. Wright, *Pres.* Elmo Thompson, Paul Taliaferro, Harry H. Mack, *V. P.s.* F. L. Martin, *V. P.* and *Gen. Mgr. Ref.* R. L. Johnson, *Supt.* A. D Vinson, *Asst. Supt.* Roy France, Allen, Okla., *Ch. Chem.* R. E. Campbell, *Pur. Agt.* J. B. Fairfield, *Traf. Mgr.* Refinery located at Allen, Okla.

Sun River Refining Co., Box 590, Great Falls, Mont.

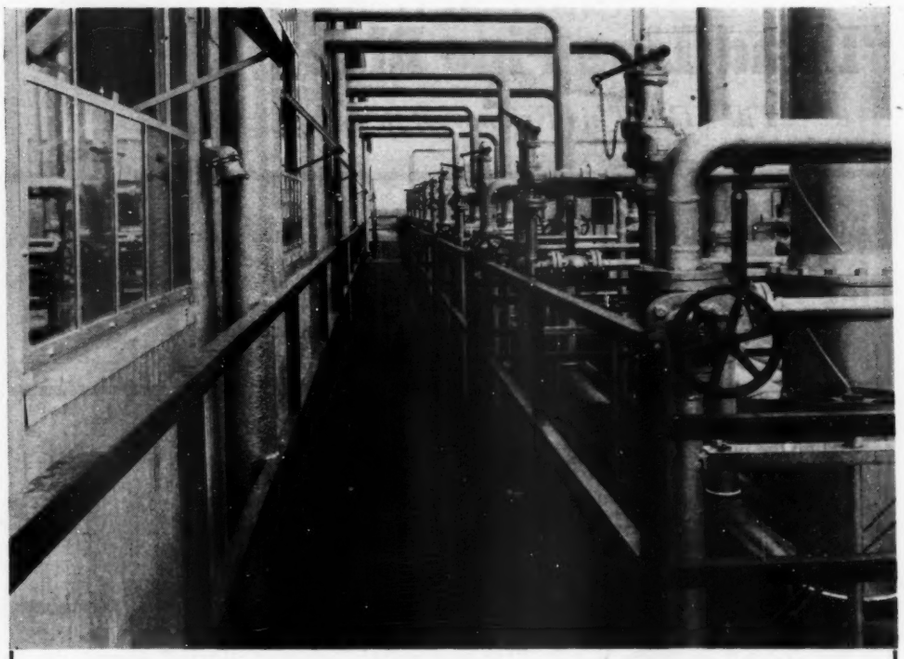
Harren Hough and F. C. Yarbrough, *Partners.* G. C. Yarbrough, *Sec.* F. C. Yarbrough, *Gen. Mgr.* Dewey Loods *Ch. Engr.* Refinery located at Great Falls. Mont.

Sunshine Refinery, Livingston, Tex.

Lyle West and J. O. Bergman, *Partners.* Plant located at Livingston, Tex.

Superior Oil Works, Box 56, Warren, Pa.

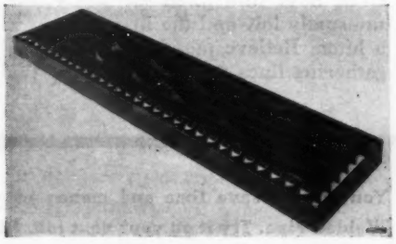
R. Z. Morrison, *Pres.* Owen E. McLeieer, *V. P.* and



ARROWHEAD NOT ONLY LOOKS SAFE—IT IS SAFE!
Snow, rain or sleet does not affect its nonslip feature.

ARROWHEAD IS ECONOMICAL—No maintenance cost of replacing (The first installation of ARROWHEAD grating is still in use after nineteen years.)

ARROWHEAD TREADS are so designed that the distinctive nosing absolutely prevents the danger of overstepping and the ARRO nosing is slip proof under all conditions.



Write for our engineer's handbook on Arrowhead Grating and Treads.

ARROWHEAD IRON WORKS
431 West 5th Street KANSAS CITY, MO.

Gen. Mgr. W. F. Clinger, *Treas.* Charles H. Eaton, *Sec.* and *Pur. Agt.* R. B. Allmendinger, *Ref. Supt.* and *Ch. Chem.* Refinery located at Warren, Pa.

Sweet Grass Oil & Refining Co., Sweet Grass, Mont.

W. N. Langford, *Supt.* Refinery located at Sweet Grass, Mont.

Sweet Oil Refining Co., Wyman, Mich.

Ray Andres, *Pres.* and *Gen. Mgr. Ref.* Albert Kessler, *Sec.* and *Treas.* Lloyd Wheeler, *Sales Mgr.* Floyd Bacon, *Gen. Supt. Ref.* Refinery located at Wyman, Mich.

T

Talco Asphalt & Refining Co., Box 1011, Mount Pleasant, Tex.

Capt. J. F. Lucey, *Pres.* Toddie Lee Wynne, *V.P.* Joe Dranguet, *Sec.* and *Treas.* W. L. Scott, *Sales Mgr.* J. A. MacKinnon, *Gen. Mgr.* H. O. Sivess, *Supt. Ref.* E. T. Lance, *R. & D.* Ashley Johnson, *Ch. Chem.* R. D. McCrum, *Ch. Engr.* R. B. Slay, *Pur. Agt.* T. W. Rrelford, *Traf. Mgr.* Refinery located at Mount Pleasant, Tex.

Taxman Oil Co., Box 656, Milan, Ill.

Earl C. Roff, *Pres.* and *Gen. Mgr.* R. S. Wilkins, *V. P.* I. W. Siegel, *Sec., Treas.,* and *Sales Mgr.* J. E. Pyson, *Ch. Chem.* J. L. Kolb, *Pur. Agt.* Refinery located at Milan, Ill.

Taylor Refining Co., Taylor, Tex.

G. L. Rowsey, *Pres.* and *Gen. Mgr.* J. F. Whitehurst, *V. P.* and *Sales Mgr. Retl.* Neil Buckley, *V. P.* and *Sales Mgr. Whsle.* C. C. Rockenback, *V. P.* Harris A. Melasky, *Sec.* and *Treas.* Dorothy V. West, *Asst. Sec.* W. R. Arrington, *Asst. Treas.* James L. Sewell, *Gen. Supt. Ref.* B. H. Perkinson, Corpus Christi, Tex.; H. M. Wilson, Taylor, *Supts.* D. A. Porter, *Ch. Chem.* Refineries located at Taylor and Corpus Christi, Tex.

Terminal Refining Corp., Box 1500, Corpus Christi, Tex.

T. E. McArdle, *Pres.* and *Sales Mgr.* Dan D. Rogers, C. Andrade III, *V.P.s.* C. M. Hall, *Sec.* and *Treas.* P. F. McArdle *Gen. Mgr. Ref.* and *Pur. Agt.* J. E. McArdle, *Gen. Supt. Ref.* W. S. Cazort, Jr., *Ch. Chem.* J. S. Presnall, Jr., *Traf. Mgr.* Refinery located at Corpus Christi, Tex.

Texas Co. (Delaware), The, 135 E. 42nd St., New York, N. Y.

W. S. S. Rodgers, *Pres.* M. Halpern, *V. P. Ref. Dept.* H. W. Dodge, H. T. Klein, J. S. Leach (Houston), R. Ogarrio, C. E. Olmstead, *V. P.s.* R. L. Saunders, *Sec.* L. H. Lindeman, *Treas.* F. P. Dodge, Port Arthur; F. S. Dengler, Port Neches; S. W. Darling, Houston; R. G. Collins, West Dallas; W. K. Holmes, West Tulsa; W. B. Logan, Lockport; H. C. Wakefield, Pryse; A. E. Higgs, San Antonio; G. C. McSwain, Amarillo; H. A. Fouts, El Paso; L. F. J. Wilking, Casper; W. A. Martin, Calpet; G. O. Shefstead, Craig; C. J. King, Cody; H. S. McCray, Sunburst; J. R. Reed, Norfolk; C. G. Cramer, Claymont; V. B. Pevoto, Providence, *Ref. Supts.* W. F. Moore, New York, *Mgr. Pur.* Refineries located at Port Arthur, Tex.; Port Neches, Tex.; Houston, Tex.; West Dallas, Tex.; San Antonio, Tex.; El Paso, Tex.; Amarillo, Tex.; West Tulsa, Okla.; Pryse, Ky.; Lockport, Ill.; Casper, Wyo.; Craig, Colo.; Cody, Wyo.; Calpet, Wyo.; Sunburst, Mont.; Norfolk, Va.; Claymont, Del.; Providence, R. I.

Texas Co. (California), The, 929 S. Broadway, Los Angeles, Calif.

W. S. S. Rodgers, New York City, *Pres.* T. H. Webb *V. P.* and *Gen. Mgr.;* L. R. Holmes, *V. P. Ref. Dept.* Los Angeles. R. L. Saunders, *Sec.;* L. H. Lideman, *Treas.;* W. F. Moore, *Mgr. Pur. Dept.,* New York City. W. J. Ryan, Los Angeles, J. R. Scanlin, Fillmore, *Supts.* Refineries located at Los Angeles and Fillmore, Calif.

Three Rivers Refinery, Box 157, Three Rivers, Tex.

Henderson Coquat, *Pres.* James O. Coquat, *V. P.* and *Treas.* Lee Peters, *Sec.* W. B. Pape, *Sales Mgr.* Ralph Robinson, *Gen. Mgr. Ref.* R. A. Ellerman, *Traf. Mgr.* Refinery located at Three Rivers, Tex.

Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

William F. Humphrey, *Pres.* C. R. Barton, L. F. Bayer, J. D. Collins, L. C. Decius, B. I. Graves, K. R. Hankinson, George J. Hanks, L. D. Jurs, R. B. Pringle, R. E. Ryerson, E. H. Salrin, *V. P.s.* William J. Burker, *Sec.* K. R. Hankinson, *Treas.* H. S. Chase, Bayonne; L. M. Jagou, Drumright; T. O. Edwards, Jr., Avon; D. D. Stark, Watson, *Ref. Supts.* G. C. Cain, Bayonne, *Asst. Supt.*

Eastern Division:

R. E. Ryerson, *Sales Mgr., Whlse.* J. D. Collins, *Domestic Sales Mgr.* C. R. Barton, *Gen. Mgr. Ref.* F. W. Keebler, *Process Supt.* J. P. McCoy, *Mgr. R. & D.* R. S. Stanfield, *Ch. Engr.* A. Jungdahl, *Pur. Agt.* C. F. Dowd, *Traf. Mgr.* D. Rothbard, *Ch. Chem.*

Mid-Continent Division:

J. W. Warner, *Sales Mgr., Retl.* G. R. Kinter, *Gen. Mgr. Ref.* M. F. Bridges, *Pur. Agt.* J. R. Lewallen, *Traf. Mgr.* R. W. Boyd, *Ch. Chem.* O. A. Gierow, *Mech. Supt.*

Western Division:

P. E. Allan, *Gen. Sales Mgr.* W. A. Reanier, *Domestic Sales Mgr.* J. J. Lerman, Jr., *Export Sales Mgr.* W. P. Hugo, *Gen. Mgr. Ref.* O. Larsen, *Process Supt.* H. Y. Hyde, *Mgr. R. & D.* A. P. MacKillon, *Pur. Agt.* R. Hucherson, *Traf. Mgr.* L. Mittelman, *Ch. Chem.* P. H. Woods, *Mech. Supt.* Refineries located at Bayonne, N. J.; Drumright, Okla.; Avon, Calif.; Watson, Calif.

Tiernan Refining Co., 1650 E. Spring St., Long Beach, Calif.

P. S. Tierman, *Owner* and *Gen. Supt.* J. W. Tierman, *Gen. Mgr. Ref.* Willard Moss, *Asst. Supt.* Hugh McCormick, *Process Supt.* Thomas Corcoran, *Ch. Chem.* Refinery located at Signal Hill (Long Beach), Calif.

Titan Refining Co., Plymouth, Mich.

Refinery located at Plymouth, Mich.

Tracy Development Corp., 613 Financial Center Bldg., Oakland, Calif.

Jason A. Loughridge, *Pres.* Frank T. Thompson, *V. P.* Ernest F. Bachtold, *Sec.* and *Treas.* Refinery located at Maricopa, Calif.

Transport Oil & Refining Co., 12 Arcade Bldg., St. Louis, Mo.

W. B. Fitzgerald, *Pres.* George G. Snodgrass, *Sec.* Custer N. Gregory, *Treas.* and *Gen. Supt. Ref.* Kenneth B. Gregory, *Sales Mgr.* and *Gen. Mgr. Ref.* Refinery located at Dupo, Ill.

Treasure State Refining Co., Box 604, Shelby, Mont.

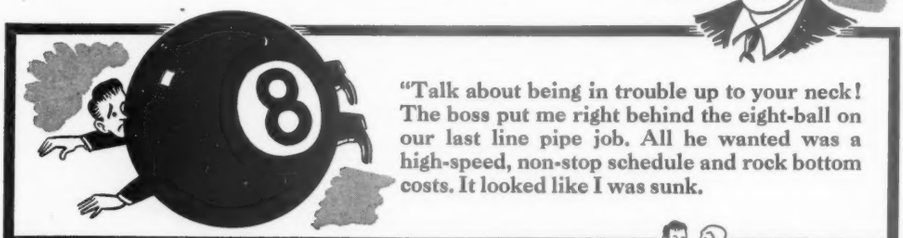
Frank P. Walsh, *Owner.* R. M. Kelly, *Gen. Mgr. Ref.* Refinery located at Shelby, Mont.

Tri-State, Inc., Thermopolis, Wyo.

J. H. Walden, *Pres., Sales Mgr., Pur. Agt.* and *Traf. Mgr.* Zallie Walden, *V. P.* and *Sec.* and *Treas.* John

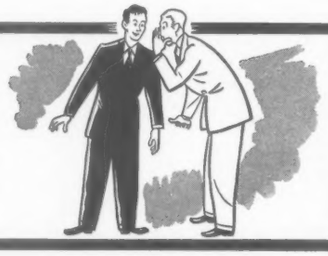
"I Had 'Line Pipe Blues'

Till I Got This Friendly Tip"



"Talk about being in trouble up to your neck! The boss put me right behind the eight-ball on our last line pipe job. All he wanted was a high-speed, non-stop schedule and rock bottom costs. It looked like I was sunk.

"Then the pipe contractor gave me a tip on 'Selective Buying' with ARMCO Spiral Welded Pipe. He said this plan had been saving money in major oil fields for more than 10 years and that ARMCO always had the pipe on the job when promised.



"He was right! 'Selective Buying' turned the trick. By using ARMCO Spiral Welded Pipe, we got the exact size and wall thickness we needed without paying for excess weight. And ordering ARMCO Pipe in lengths up to 50 feet meant fewer sections to handle, fewer joints to weld.

"The boss sure liked the job. Costs were unusually low and the line went in without a hitch. Believe me, from now on, all our gathering lines go ARMCO Spiral Welded."

You too can save time and money by using "selective buying" with ARMCO Spiral Welded Pipe. Try it on your next job. Diameters range from 6 to 36 inches, wall thicknesses from 7-64 to ½-inch. Write our nearest office for prices and reliable delivery dates. The American Rolling Mill Company, Pipe Sales Division, 1141 Curtis Street, Middletown, Ohio; 501 Mayo Building, Tulsa, Okla.; 3500 Maury Street, Houston, Texas.

Herrin, *Gen. Mgr. Ref.* and *Gen. Supt. Ref.* Paul Lierboe, *Mgr. R. & D.* and *Ch. Chem.* Refinery located at Thermopolis, Wyo.

Tri-State Refineries, Inc., Box 316, Henderson, Ky.
A. J. Slagter, *Pres.* and *Gen. Mgr. Ref.* E. B. Paulson, *V.P.* A. J. Slagter, Jr., *Sec.* R. Hal Compton, *Treas.* Lewis E. Owen, *Sales Mgr.* John L. Benton, *Ref. Supt.* Refinery located at Spottsville, Ky.

Troy Refining Corp., Troy, Ind.
Auburn Stinson, *Pres.* C. D. Schrieber, *V. P.* Dewey Stinson, *Sec.* and *Treas.* and *Gen. Mgr. Ref.* Plant located at Troy, Ind.

Trumbull Asphalt & Refining Co., 5440 W. 67th St., Chicago, Ill.
Robert F. Trumbull, *Pres.* J. Aikens Miller, *V. P.* John Trumbull, *Sec.* Robert F. Trumbull, *Treas.* R. B. Smith, *Sales Mgr.* and *Gen. Mgr. Ref.* Gene Genard, *Gen. Supt. Ref.* H. G. Taggart, *Ch. Engr.* A. C. Tresise, *Pur Agt.* and *Traf. Mgr.* Refineries located at Alma and West Branch, Mich.

Tucker Oil Co., 1210 City Natl. Bank Bldg., Wichita Falls, Tex.
J. J. Perkins, *Pres.* Charles J. Tucker, *V. P., Sales Mgr.* and *Gen. Mgr. Ref.* Harold Murph, *Sec.* and *Treas.* L. B. Horr, *Supt.* Roy E. Wood, *Asst. Supt.* Refinery located at Burkburnett, Tex.

Tyreco Refining Co., Artesia, N. M.
Refinery located at Artesia, N. M.

Tydal Refining Co., Inc., Box 553, Gainesville, Tex.
J. B. Morrow, *Pres.* E. R. Willett, *Sec.* and *Treas.* C. M. Jones, *Ref. Supt.* W. O. Price, *Ch. Chem.* Refinery located at Gainesville, Tex.

U

Ultra-Penn Refining Co., Bruin, Pa.
Wm. H. Miller, *Receiver.* S. L. Gehr, *Sales Mgr.* G. M. Lyons, *Gen. Mgr. Ref.* C. J. McCorry, *Supt.* W. R. Storey, *Ch. Chem.* W. J. Davenport, *Ch. Engr.* S. L. Gehr and C. J. McCorry, *Pur. Agts.* A. C. Burrows, *Traf. Mgr.* Refinery located at Bruin, Pa.

Union Oil Co. of California, 617 W. Seventh St., Los Angeles, Calif.
Reese H. Taylor, *Pres.* W. L. Steward, Jr., A. C. Rubel, A. C. Galbraith, A. C. Stewart, *V. P.s.* W. R. Edwards, *Sec.* H. W. Sanders, *Treas.* M. G. Kerr, *Comptroller.* W. A. Newhoff, *Mgr. Domestic Sales.* J. B. Arthur, *Mgr. Foreign Sales.* Sherman Doty, *Supervisor Ref. Oper.* Earle W. Gard, *Mgr. R. & D.* H. C. Farquhar, *Mgr. Purchases.* Refineries located at Wilmington, Oleum (near San Francisco), and Maltha (near Bakersfield), Calif.

Universal Refineries, Inc., Box 134, Pueblo, Colo.
R. G. Windsor, *Pres., Sales Mgr., Gen. Mgr. Ref.,* and *Pur. Agt.* J. R. Bailey, *V. P.* and *Gen. Supt. Ref.* Oran Robinson, *Sec.* and *Treas.* Refinery located at Pueblo, Colo.

United Refining Co., Warren, Pa.
F. C. Bannerot, *Pres.* H. A. Logan, *V. P.* and *Gen. Mgr.* H. W. Schmidt, *Sec.* and *Asst. Treas.* H. A. Logan, *Treas.* Refinery located at Warren, Pa.

Unity Petroleum Corp., Shelby, Mont.
Boris A. S. Aronow, *Pres.* and *Treas.* Willard B. Aronow, *Gen. Mgr. Ref.* Refinery located at Kalispell, Mont.

Upton Refinery, Upton, Wyo.
Michael T. Martin, *Pres.* and *Sales Mgr. Rtl.* George K. Martin, *Sales Mgr. Whsle.* Refinery located at Upton, Wyo.

Utah Oil Refining Co., P. O. Box 898, Salt Lake City, Utah.
T. A. Dines, *Pres.* Wm. R. Wallace, E. S. Holt, A. N. Johnson, M. J. Greenwood, *V. P.s.* A. N. Johnson, *Sec.* and *Treas.* F. R. Clark, *Ref. Supt.* R. C. Watkins, *Proc. Supt.* A. W. Neeley, *Mgr. R. & D.* G. I. Kirby, *Ch. Chem.* Robert G. Clark, *Ch. Engr.* Keros H. Searle, *Pur. Agt.* Refinery located at Salt Lake City, Utah.

Uvalde Rock Asphalt Co., San Antonio, Tex.
Glenn H. Alvey, *Pres.* W. A. Smith, H. R. Brown, Joe E. Carroll, *V. P.s.* A. B. Alvey, *Sec.* and *Pur. Agt.* R. B. Smith, Blewett, *Gen. Mgr. Ref.* Refinery located at Blewett, Tex.

V

Valley Refining Co., Box 11, Harlingen, Tex.
A. B. White, *Owner* and *Mgr.* R. Clinton Beck, *Asst. Mgr.* D. A. Grover, *Sales Mgr.* J. E. Day, *Gen. Mgr. Ref.* Refinery located at Harlingen, Tex.

Valley Refining Co., E. College Blvd., Roswell, N. M.
S. W. Lodewick, *Pres.* H. C. Buchly, *V. P.* S. P. Johnson, Jr., *Treas.* S. W. Lodewick, *Gen. Mgr. Ref.*

GLIDDOL
LECITHIN
(from Soybeans)

REFINERS USE GLIDDOL IN GASOLINE

1. To prevent haze and lead deposit.
2. To stabilize color of leaded gasoline.
3. To combat corrosion of drum and tank storage.
4. To aid other inhibitors.
5. To stabilize anti-knock reagents and help maintain octane number of gasoline containing the same.

●

Refiners use from 1 lb. to 15 lbs. of GLIDDOL per 1000 bbls. of gasoline at a cost of a small fraction of a cent per bbl. GLIDDOL has been successfully used by leading refiners for over four years.

●

LICENSES ON UNIFORM TERMS OFFERED TO ALL REFINERS

The Glidden Company has granted and offers to grant licenses to any refiner to use the inventions of U. S. Patents Nos. 1,884,899; 2,155,678; 2,165,651 and 2,208,105 for a royalty and without restriction as to the source of the lecithin or any other material. Licenses also available under foreign patents.

Write for sample of GLIDDOL

THE GLIDDEN CO.
Drawer "B"
ELMHURST, L. I., NEW YORK

E. A. Wahline, *Gen. Supt. Ref.* J. G. Danforth, *Ch. Chem.* Refinery located at Roswell, N. M.

Valvoline Oil Co., Fifth & Butler Sts., Cincinnati, Ohio.

E. W. Edwards, *Chm. Bd.* G. P. Doll, *Pres.* C. J. Leroux, *V. P.* and *Treas.* C. C. Gould, *V. P.* and *Sec.* C. W. Luton, *V. P.* and *Gen. Mgr. Ref.* H. M. Hart, J. M. Marshall, J. H. Garlough, *V. P.s.* C. M. Noyes, *Ref. Supt.* A. S. Hagan, H. W. Winkler, *Asst. Supts.* L. A. Calkins, *Mgr. R. & D.* E. H. Shepherd, *Pur. Agt.* E. A. Barror, *Traf. Mgr.* Refinery located at East Butler, Pa.

Vickers Petroleum Co., The, Wichita, Kans.

C. L. Henderson, *Pres.* and *Gen. Mgr.* H. G. Shaw, *V. P.* and *Pur. Agt.* J. B. Smith, *V. P.* and *Sales Mgr.* John S. Wertz, *Sec.* and *Treas.* A. M. Schrepfer, *Supt.*; R. N. Moore, *Asst. Supt.*; Warren Procter, *Ch. Chem.*, Potwin. Refinery located at Potwin, Kans.

W

Waggoner, W. T., Estate (Refining Dept.), Box 2100, Vernon, Tex.

G. L. Waggoner, *Pres.* Harry Jenkins, *Sales Mgr.* G. M. Shanor, *Gen. Mgr. Ref.* J. O. Walkup, *Gen. Supt.* Refinery located at Electra, Tex.

Wasatch Oil Refining Co., 803 McIntyre Bldg., Salt Lake City, Utah.

William H. McIntyre, Jr., *Pres.* Henry D. Moyle, *V. P.* Chester G. Davis, *Sec., Treas* and *Pur. Agt.* James D. Moyle, *Sales Mgr.* Kenneth W. Yeates, *Gen. Mgr. Ref.* Claude Owens, *Gen. Supt. Ref.* Archie Hale, *Asst. Supt.* George Hibler, *Ch. Chem.* Leonard Wiscomb, *Ch. Engr.* James Eldredge, *Traf. Mgr.* Refinery located at Woods Cross, Utah.

Waverly Oil Works Co., Fifty-fourth St. and A.V.R.R., Pittsburgh, Pa.

S. M. Vockel, *Pres.* W. H. Millhiser, F. W. Wappat, *V. P.s.* Thomas A. Walker, *Sec.* S. K. Cunningham, *Treas.* T. F. O'Leary, *Sales Mgr. Whse.* W. H. Millhiser, *Gen. Mgr. Ref.* and *Pur. Agt.* Corey James, *Ref. Supt.* Dr. W. T. Sieber, *Mgr. R. & D.* A. J. Bevevino, *Ch. Engr.* Samuel Fox, *Traf. Mgr.* Refinery located at Pittsburgh, Pa.

Western Refining Co., Corsicana, Tex.

H. L. Anderson, *Gen. Mgr.* Refinery located at Baldridge Switch, Fort Stockton, Tex.

Wheatco Refining Co., Box 96, Wheatland, Wyo.

Refinery located at Wheatland, Wyo.

Whitlash Refining Co., Whitlash, Mont.

Richard Barnett and B. H. Murray, *Partners.* Refinery located at Whitlash, Mont.

Whitman, A. J., Refinery, Le Roy, Wyo.

A. J. Whitman, *Owner.* Refinery located at Le Roy, Wyo.

Wickett Refining Co., Box 307, Wickett, Tex.

W. B. Hassett, *Pres.* R. H. Hassett, *V. P., Treas.*, and *Gen. Supt. Ref.* C. C. Green, *Sec.* and *Asst. Supt.* E. L. Kent, *Sales Mgr.* Jack Strickler, *Proc Supt.* Refinery located at Wickett, Tex.

Wilcox, H. F., Oil & Gas Co., Box 1440, Tulsa, Okla.

Homer F. Wilcox, *Pres.* Frank H. Dunn, *V. P.* Melvin P. Appleby, *V. P.* and *Treas.* Carl L. Miller, *Sec.* Thomas H. Riggin, *Sales Mgr. Whsle.* L. G. Murrell, *Sales Mgr. Retl.* William M. Fraser, Box 1050, Bristow, *Gen. Mgr. Ref.* W. R. Bingham, *Ch. Engr.* and *Pur. Agt.* Refinery located at Bristow, Okla.

Wilshire Oil Co., Inc., 1206 Maple Ave., Los Angeles, Calif.

George L. Machris, *Chm. Bd.* and *Pres.* M. A. Machris, *V. P.* and *Gen. Mgr. Ref.* Guy Linton, *Sec.* and *Treas.* F. R. Sheller, *Sales Mgr. Whsle.* S. F. Deutsch, *Sales Mgr. Retl.* John Beddow, *Gen. Supt. Ref.* and *Supt. Dubbs unit.* Fred Behrens, *Supt. Polymerization and Treating unit* and *Mgr. R. and D.* Norman Tyack, *Asst. Supt. Dubbs unit.* John Ouding, *Asst. Supt. Polymerization and Treating unit.* Frederick Scherf, *Ch. Chem.* O. E. Liddell, *Ch. Engr.* A. A. Pateracki, *Pur. Agt.* C. A. Shoop, *Traf. Mgr.* Refinery located at Norwalk, Calif.

Wireback, B. F. (Owner and Operator), Plymouth, Ill.

Plant at Plymouth, Ill.

Wisconsin Oil Refining Co., Inc., Box 507, Sheboygan, Wis.

William H. Pauly, *Chm. Bd.* D. E. Foster, *Pres.* Walter H. Wingrove, *V. P.* T. H. Spence, *Sec.* John Heronymus, *Treas.* D. E. Foster, *Gen. Mgr. Ref.* John A. Crawford, *Gen. Supt. Ref.* Sam McCollum, *Asst. Supt.* George E. Lowe, *Traf. Mgr.* Refinery located at Sheboygan, Wis.

Wolf's Head Oil Refining Co., Inc., Box 56, Oil City, Pa.

C. H. Ellingwood, *Chm. Bd.* E. W. Chase, *Pres.* A. W. Scott, *V. P.* and *Sec.* F. S. Smith, *Asst. Treas.* A. W. Cole, *Supt.* B. H. Waterbury, *Prod. Mgr.* L. M. Batizell and F. S. Smith, *Ch. Chems.* W. J. Scott, *Pur. Agt.* L. R. Cavanaugh, *Traf. Mgr.* Refinery located at Reno, Pa. Plant owned and operated jointly with Pennzoil, Quaker State and Continental Refining Co.

Wood River Oil Refining Co., Inc., Globe Bldg., Wichita, Kans.

O. H. Ingram, F. C. Koch, F. L. Jehle, *V. P.s.* R. E. Everitt, *Sec.* and *Treas.* J. F. Reidy, *Sales Mgr.* J. A. O'Neill, Hartford, *Ref. Supt.* Refinery located at Hartford, Ill.

Worth Refining Co., Inc., 624 S. Michigan Ave., Chicago, Ill.

T. F. Thompson, *Pres.* George E. Phoenix, *V. P.* E. U. Rehberg, *Sec.* and *Treas.* F. O. Case, *Ref. Supt.* and *Pur. Agt.* Charles Tomaska, *Asst. Supt.* Joseph Childers, *Process Supt.* James E. Klein, *Ch. Chem.* John T. Brennan, *Traf. Mgr.* Refinery located at Blue Island, Ill.

Y

Yale Oil Corp., Box 2094, Billings, Mont.

L. B. Hancock, *Pres.* and *Treas.* Bessie Hancock, *V. P.* P. N. Fortin, *V. P., Sec.*, and *Gen. Mgr.* R. D. Shipley, *Sales Mgr.* C. J. Mowery, Billings, Mont., *Gen. Supt.* J. C. Burke, Kalispell, Mont.; W. S. Shaw, Lovell, Wyo.; Marx Krogman, Worland, Wyo., *Supts.* T. R. Corbett, *Mgr. R. & D.* C. W. Bohling, *Pur. Agt.* L. C. Wilson, *Traf. Mgr.* Refineries located at Billings and Kalispell, Mont.; Lovell and Worland, Wyo.

Yosemite Oil Refining Co., Box 205, Bakersfield, Calif.

Curtis Flint, *Pres.* and *Treas.* Hattie P. Flint, *V. P.* C. S. Fite, *Sec.* and *Sales Mgr.* Louis Steneman, *Supt.* Refinery located at Fruitvale, Calif.

Z

Z. & W. Service & Refinery, Torrington, Wyo.

F. A. Zimmer and A. Whelen, *partners.* Mrs. F. A. Zimmer, *Sec.* and *Gen. Mgr.* F. A. Zimmer, *Treas.* Harry Gillett, *Asst. Supt.* Plant located at Torrington, Wyo.

For Visibility's Sake make it

REFLEX GAGES

FOR THAT ADDED SAFETY FACTOR

make it

JERGUSON

REFLEX GAGES

They're built to stand up under the high pressures and temperatures encountered in refinery operations. Study the cross-section and note the heavy bar steel U-bolt which reinforces the assembly. Metal parts are rugged, of special alloy steels, to take the brunt of the stresses. The glass is the best obtainable, selected for high temperature work and carefully tempered to withstand pressures.

The name JERGUSON has long been identified with the highest quality column gages. You can rely upon them.

JERGUSON GAGE & VALVE CO.

85 FELLSWAY SOMERVILLE, MASS.

Personnel of Refineries in Canada

A

Anglo-Canadian Oils, Ltd., Box 98, Brandon, Manitoba.

W. S. Campbell, *Pres.* N. W. Kerr, *Sec.* R. J. Christian, *Gen. Mgr. Ref.* W. J. Dubesky, *Ref. Supt.* W. J. Dubesky, *Ch. Engr.* Refinery located at Brandon, Manitoba.

B

Becker Refineries, Ltd., Royalties, Alberta, Canada.

British American Oil Co., Ltd., The, Royal Bank Building, Toronto, Ontario, Canada.

Albert L. Ellsworth, *Pres.* F. A. Gaby, *Exec. V. P.* C. L. Suhr, *V. P.* H. H. Bronsdon, *Sec.* J. C. Millar, *Treas.* A. H. Miller, *Sales Mgr.* L. E. Wooley, *Gen. Supt. Ref.* M. S. Beringer, Toronto; R. L. Rude, Montreal; J. K. Jamieson, Moose Jaw; H. E. Saunders, Calgary, *Ref. Supts.* E. C. Hurd, Toronto; W. C. Gault, Montreal; M. T. Stevens, Moose Jaw; D. L. Campbell, Calgary, *Asst. Supts.* R. O. Campbell, *Ch. Chem.* C. D. Read, *Ch. Engr.* J. E. Joyce, *Pur. Agt.* R. Winfield, *Traf. Mgr.* Refineries located at Toronto, Ontario; Montreal East, Quebec; Moose Jaw, Saskatchewan, Calgary, Alberta, Canada.

C

Canadian Oil Companies, Ltd., Petrolia, Ontario, Canada.

John Irwin, *Pres.* Frank C. West, *V. P.* Earl A. Smith, *Ref. Supt.* V. Norwood, *Ref. Tech.* Refinery located at Petrolia, Ontario, Canada.

Carman Oil Refinery, The, Ltd., Carman, Manitoba, Canada.

W. R. Vankoughnet, *Pres.* John Ainslie, *V. P.* V. G. Hurst, *Treas.* S. C. Crawford, *Sales Mgr.* E. E. Murphy, *Gen. Mgr. Ref.* Refinery located at Carman, Manitoba, Canada.

Champlain Oil Products, Ltd., Sun Life Bldg., Montreal, Quebec, Canada.

Harry Snyder, *Chm. Bd.* F. T. McKean, *Pres.* J. E L. Duquet, *Sec.* F. E. Smith, *Treas.* J. O. Tremblay, *Sales Mgr.* Refinery located at Montreal, Quebec, Canada.

Comet Refining Co., Ltd. (successor to Hydro-Pete Oils, Ltd.), Red Deer, Alberta, Canada.

A. E. Knight, *Pres.* Refinery located at Red Deer, Alberta, Canada.

Consumers Co-Operative Refineries, Ltd., Box 399, Regina, Saskatchewan.

E. E. Frisk, *Pres.* V. C. Thomas, D. V. Runkle, T. W. Barmby, *V. P.s.* H. L. Fowler, *Sec.* and *Sales Mgr.* E. T. Mowbrey, *Treas.* O. B. Males, *Gen. Supt. Ref.* O. B. Males, *Ref. Supt.* S. C. McClelland, *Ch. Chem.* C. C. Humbert, *Ch. Engr.* H. E. Gooderich, *Pur. Agt.* G. E. Smith, *Traf. Mgr.* Refinery located at Regina, Saskatchewan.

D

Dina Oil & Ref. Co., Ltd., Dina, Alberta, Canada.

E

Eston Refining Co., Ltd., Eston, Saskatchewan.

William Hollar, *Pres.* R. E. Hartsook, *Sales Mgr.* H. C. Spaetgens, *Gen. Supt. Ref.* T. H. McMath, *Ref. Supt.* Refinery located at Eston, Saskatchewan.

G

Gas & Oil Products, Ltd., 300 Lancaster Building, Calgary, Alberta, Canada.

A. H. Mayland, *Pres.* William Kemp, *Sec.-Treas.* W. F. McKinley, *Sales Mgr.* L. A. Boyd, *Gen. Supt. Ref.* M. Neilson, *Asst. Ref. Supt.* William C. Fisher, *Ch. Chem.* James Wilson, *Traf. Mgr.* Refinery located at Hartell, Alberta, Canada.

General Petroleum Refineries, Pointe-aux-Trembles, Quebec, Canada.

Refinery located at Pointe-aux-Trembles, Quebec.

Gold Standard Oils, Ltd., Wainwright, Alberta, Canada.

W. B. Underhill, *Pres.* W. A. Keenen, *Sec.* and *Sales Mgr.* J. L. Howes, *Ref. Supt.* Refinery located at Wainwright, Alberta, Canada.

Good Rich Refining Co., Ltd., Port Credit, Ontario.

R. Rosefield, *Pres.* J. H. Davis, *Sec.-Treas.* J. N. Fitz Gerald, *Sales Mgr.* F. K. Davis, *Gen. Mgr.* and *Gen. Supt. Ref.* H. M. Webb, *Ch. Chem.* C. W. Matthews, *Pur. Agt.* R. W. Howsam, *Traf. Mgr.* Refinery located at Port Credit, Ontario, Canada.

H

Hi-Way Refineries, Ltd., 714 Border Bldg., Regina, Saskatchewan.

S. J. Sackett, *Pres.* A. E. O'Brien, *V. P.* and *Gen. Mgr.* F. B. Bagshaw, *Sec.* L. C. Slater, *Treas.* H. E. McDonald, *Sales Mgr.* Charles Hay, Saskatoon; J. A. Kelly, Moose Jaw, *Supts.* Refineries located at South Edmonton, Alta; Saskatoon, Rosetown, Swift Current, Moose Jaw, Weyburn, Regina (2 plants), Saskatchewan.

Home Oil Distributors, Ltd., 555 Burrard St., Vancouver, British Columbia, Canada.

H. G. Fowler, *Chm. Bd.* E. H. Teagle, *Pres.* A. Davis, *Sec.-Treas.* L. J. Martin, *Sales Mgr.* D. Fraser, *Gen. Mgr. Ref.* Claire Willis, *Ch. Chem.* D. Fraser, *Pur. Agt.* Refinery located at North Vancouver, British Columbia, Canada.

Home Oil & Refining Co., Ltd., Humboldt, Saskatchewan, Canada.

H. C. Karels, *Pres.* C. C. Karels, *V. P.* R. Balfour, *Sec.* A. Schaffer, *Sales Mgr.* C. Posten, *Gen. Supt. Ref.* S. R. Smith, *Ch. Chem.* H. C. Karels, *Pur. Agt.* A. Schaffer, *Traf. Mgr.* Refinery located at Humboldt, Saskatchewan, Canada.

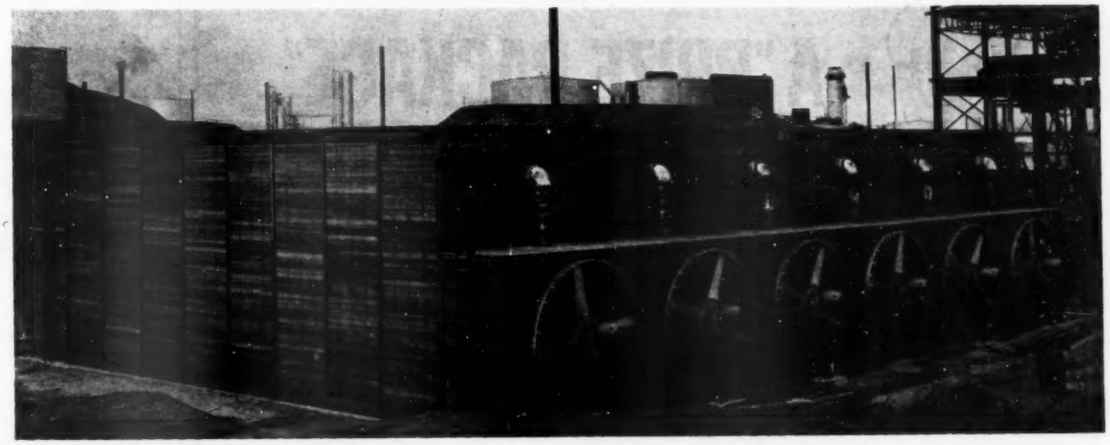
Huff Refinery Co., Ltd., Lethbridge, Alberta, Canada.

Floyd J. Huff, *Pres.* A. R. Huff, *V. P.* and *Treas.* G. A. McDonald, *Sec.* Floyd J. Huff, *Sales Mgr.* and *Gen. Mgr. Ref.* W. R. Varcoe, *Ref. Supt.* Refinery located at Lethbridge, Alberta, Canada.

I

Imperial Oil, Ltd., 56 Church St., Toronto 2, Ontario, Canada.

G. H. Smith, *Pres.* C. A. Eames, R. V. LeSuer, L. C. McCloskey, John McNeil, A. E. Halverson, *V. P.s.* F. E. Holbrook, *Sec.-Treas.* G. L. Stewart, *Gen. Mgr.*



Mechanical Draft Cooling Towers

The forced draft, low head tower illustrated is typical of installations widely made for refinery conditions during the last two years. The photograph shows 12 of the 500 mechanical draft, low pumping head, cooling tower cells already furnished or on order. The number used in Petroleum Refinery alone would make a single tower about a mile long!

Foster Wheeler originated and put into service the first such cooling towers involving only 20′ pumping head less than three years ago. By effecting large savings in pumping charges, the low head design enabled the refiner to attain a long-sought objective—all-season cooled water from a closed circuit. Mechanical draft provided the necessary, all-season productivity and low pumping head maintained operating expense at the same cost as atmospheric towers. In cool weather, two important power savings can be made by adjustment of fan blade angle and operation of only such fans as are required to obtain the desired water temperature.

Foster Wheeler Corporation
165 Broadway New York, N. Y.

FOSTER WHEELER

Ref. A. D. Grant, Ioco, British Columbia; C. M. Moore, Calgary, Alberta; A. C. Harrop, Regina, Saskatchewan; C. E. Carson, *Gen. Supt.* and J. D. Bradley, *Ref. Supt.*, Sarnia, Ontario; F. C. Mechin, Montreal, Quebec; R. L. Dunsmore, Dartmouth, Nova Scotia, *Ref. Supts.* C. E. Stone, Ioco, British Columbia; J. J. Hanna, Calgary, Alberta; C. R. Moore, Regina, Saskatchewan; J. W. McDonald, Sarnia, Ontario; L. T. McNaughton and L. C. Lajoie, Montreal, Quebec; R. D. King, Dartmouth, Nova Scotia, *Asst. Supts.* Dr. R. K. Stratford, *Mgr. R. & D.* Gordon McIntyre, *Ch. Chem.* T. Montgomery, *Ch. Engr.* L. E. Bury, *Pur. Agt.* Refineries located at Ioco, British Columbia; Calgary, Alberta; Regina, Saskatchewan; Sarnia, Ontario; Montreal, Quebec; Dartmouth, Nova Scotia; Fort Norman, Northwest Territories, Canada.

L

Lion Oils, Ltd., 9328A, Eighth Ave. West, Calgary, Alberta, Canada.

L. O. Beauchemin, *Pres.* J. R. Henderson, *Sec.* L. L. Plotkins, *Sales Mgr.* and *Gen. Mgr. Ref.* Refinery located at Calgary, Alberta, Canada.

Mc

McColl-Frontenac Oil Co., Ltd., 420 Royal Bank Building, Montreal, Quebec, Canada.

James A. Wales, *Pres.* J. M. Pritchard, C. P. Tomlinson, H. H. Bradburn, W. A. Bishop, *V. P.s.* Fred Hunt, *Sec.-Treas.* J. M. Pritchard, *V. P. chg. Sales.* A. F. Campo, *Gen. Sales Mgr.* G. R. Taylor, *Mgr. Ref. Opr.* J. D. Brown, Montreal; C. B. W. Anderson, Toronto, *Ref. Supts.* H. M. Bolitho, Montreal; A. G. Farquharson, Toronto, *Asst. Supts.* H. B. Barton, *Ch. Chem.*, Eastern & Maritime Div. R. N. Smith, *Ch. Chem.*, Central & W. Div. R. C. Kinzer, *Ch. Engr.* B. F. Stanton, *Pur. Agt.* V. G. Smith, *Traf. Mgr.* Refineries located at Montreal, Quebec; Toronto, Ontario, Canada.

M

Mid-West Refineries, Ltd., Box 475, Dauphin, Manitoba, Canada.

Herman Deering, *Pres.* Frank Orland Wright, *V. P.* Arthur N. Kerry, *Sec.* and *Treas.* Frank Orland Wright, *Gen. Mgr.* Refinery located at Dauphin, Manitoba, Canada.

Monro, John R., Oil & Refining Co., Hubalta, Alberta, Canada.

John R. Monro, *Pres.* and *Treas.* J. L. Monro, *Sales Mgr.* S. R. Monro, *Gen. Supt. Ref.* Refinery located at Hubalta, Alberta, Canada.

New Brunswick Gas & Oilfields, Ltd., Weldon, New Brunswick, Canada.

Refinery at Weldon, New Brunswick, Canada.

Northern Petroleum Corp., Ltd., Kamsack, Saskatchewan, Canada.

S. Coxson, *Pres.* John Kalmacoff, *V. P., Sec.*, and *Sales Mgr.* Refinery located at Kamsack, Saskatchewan, Canada.

Northwest Co., Ltd., Fort Norman, Northwest Territories, Canada.

N

Natural Sodium Products, Ltd., Bishopric, Saskatchewan, Canada.

Allison Bishopric, *Pres.* L. R. Johnson, *V. P.* L. J. Douglas, *Sec.* and *Mgr. R. & D.* N. J. Hipp, *Treas.* and *Gen. Mgr. Ref.* G. H. Moore, *Sales Mgr.* Refinery located at Bishopric, Saskatchewan, Canada.

North Star Oil, Ltd., 303 Scott Block, Winnipeg, Manitoba, Canada.

Col. G. T. Chisholm, Toronto, Ontario, *Pres.* W. T. Gwyn, *V. P.* and *Treas.* T. N. Clayton, *V. P., Gen. Mgr. Ref.* and *Pur. Agt.* A. Havelock, *Sec.* W. R. Macarthur, *Sales Mgr.* C. Johnson, *Ref. Supt.* J. H. Ireland, *Traf. Mgr.* Refinery located at Winnipeg, Manitoba, Canada.

R

Radio Oil Refineries, Ltd., Munroe and Watt Sts., East Kildonan, Manitoba, Canada.

Max Hechter, *Pres.* Ben Hechter, *V. P.* Gerald M. Hechter, *Supt.* Refinery located at East Kildonan, Manitoba, Canada.

S

Shaw Petroleums, Refinery Div., Lloydminster, Alberta, Canada.

R. L. Shaw, *Pres.* and *Mgr.* H. C. Spaetgens, *Gen. Supt.* Refinery located at Lloydminster, Alberta, Canada.

Shell Oil Co. of British Columbia, Ltd., 475 Howe St., Vancouver, British Columbia, Canada.

S. Belither, *Pres.* D. Heggie, L. G. McLaren, C. E. Anstie, *V. P.s.* A. R. Bradley, *Sec.* D. Heggie, *Treas.* F. S. Clulow, *Gen. Mgr. Ref.* H. H. Hale, Shellburn, B. C., *Supt.* S. T. Covell, San Francisco, Calif.; W. H. Ball, Vancouver, *Pur. Agts.* C. E. Donaldson, *Traf. Mgr.* Refinery located at Shellburn, British Columbia, Canada.

Shell Oil Co. of Canada, Ltd., 25 Adelaide St., East Toronto, Ontario, Canada.

P. M. Fowlie, *Pres.* N. Y. Knox, *V. P.* and *Sales Mgr.* O. B. Roger, *Sec.* and *Treas.* H. N. Short, *Gen. Mgr. Ref.* F. Olmsted, *Asst. Supt.* R. D. Boylan, *Process Supt.* E. C. Wilkinson, *Ch. Chem.* H. H. Snyder, *Ch. Engr.* J. E. Halford, *Pur. Agt.* Refinery located at East Montreal, Ontario, Canada.

Standard Oil Co. of British Columbia, Ltd., 906 Marine Bldg., Vancouver, British Columbia, Canada.

R. K. Davies, *Pres.* S. E. Nord, *V. P.* and *Gen. Mgr.* G. E. Kennedy, J. H. MacGaregill, *V. P.s.* B. W. Letcher, *Sec.* V. F. Palmer, *Treas.* R. D. Baker, *Sales Mgr.* W. F. Bramstedt, *Mgr. of Oper.* D. V. Manley, *Ref. Supt.* R. A. Halloran, *Mgr. R. & D.* T. B. Terry, *Ch. Chem.* H. H. Hall, *Ch. Engr.* J. MacPherson, *Pur. Agt.* L. E. Fleming, *Traf. Mgr.* Refinery located at Vancouver, British Columbia, Canada.

Sterling Refineries, Ltd., Yorkton, Saskatchewan, Canada.

Pat McKenna, *Pres.* and *Gen. Mgr.* Thomas G. Gibson, *V. P.* and *Sales Mgr.* W. Milne, *Sec.* and *Treas.* Refinery located at Yorkton, Saskatchewan, Canada.

W

Warner Oil Refining & Distributing Co., Warner, Alberta, Canada.

P. W. Kuschel, *Pres.* L. Tenney, *Gen. Mgr. Ref.* Refinery located at Warner, Alberta, Canada.

Personnel of Refineries in Mexico

Petroleos Mexicanos, Mexico, D. F.

Petroleos Mexicanos, owned and operated by the Mexican Government, is in charge of operating the refineries which were expropriated by the government. Three of the plants formerly were operated by Compania Mexicana de Petroleo "El Aguila" (Shell) and one each by the Huasteca Petroleum Co. (Standard of New Jersey) and Pierce Oil Co. (Consolidated). The refinery management includes the following: Efrain Buenrostro, *Gen. Mgr.* Carlos L. Corcuera, *Gen. Mgr. Ref.*

A "PRIZE PACKAGE"

PROTECTS This BETTER WIRE ROPE

Every reel protecting Union's high quality wire ropes is as carefully made as the rope itself. The strength of heads, rigidity of connections, and use of only smooth-faced drums —all together form a reel built to prevent damage to the rope through shipment or handling. All known precautions are taken to insure perfect Union Wire Rope for all orders.

UNION WIRE ROPE CORPORATION
GENERAL OFFICES AND FACTORY:
2102 Manchester Ave. Kansas City, Missouri

Tulsa • Houston • Chicago • Salt Lake City
New Orleans • Monahans • Portland • Ashland, Ky.

UNION Wire Ropes

The ULTIMATE LOW COST WIRE ROPE

Refineries Operating in United States

Explanation of Terms Used in Operating Survey

(Comp.)—Complete plant, gasoline, kerosene, gas oil, fuel oil, lubricating oils, paraffin, wax, and asphalt, usually includes cracking.
(S)—Gasoline, kerosene distillate, gas oil, and fuel oil.
(L)—Lubricating oils.
(A)—Asphalt.
(C)—Same products as skimming, except equipped for cracking.
(W)—Wax.

ALABAMA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Coastal Petroleum Corp., Mobile	4,000	.....	S	
Total	4,000	.....		

ARKANSAS

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Berry Asphalt Co., Waterloo	1,500	.....	S-L-A	
Cross Co., Henry H., Smackover	6,000	1,500	S-C-L-A	Donnelly
Lion Oil Ref. Co., El Dorado	17,000	4,000	S-C-L-A	Own
Macmillan Pet. Corp., Norphlet	2,500	.....	S-L-A	
Root Pet. Co., El Dorado	12,000	6,000	S-C	Own
Stephens Ref. Co., Inc., Stephens	750	.....	S	
Total	39,750	11,500		

CALIFORNIA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Caminol Co., Ltd., Santa Fe Springs	3,500	2,200	S-C	Donnelly
Caminol Co., Ltd., Hanford	3,000	1,700	S-C	Donnelly
Capitol Crude Oil Co. of L. A., Santa Paula	160	.....	S	
Century Oil Co., Signal Hill	5,000	.....	S	
Comet Oil Co., Long Beach	1,700	1,700	S-C	Comb.
Douglas Oil & Ref. Co., Wilmington*	7,000	7,000	S-C	Dubbs
Eagle Oil & Ref. Co., Santa Fe Springs	5,500	1,500	S-C	Dubbs
El Camino Ref. Co., Los Alamitos	3,000	.....	S	
Elm Oil Co., Long Beach	2,500	.....	S	
El Tejon Oil & Ref. Corp., Mountain View	3,500	2,000	S-C	Dubbs
Envoy Pet. Co., Long Beach	3,500	.....	S	
Exeter Ref. Co., Long Beach	10,000	.....	S-A	
Field, O. C., Gasoline Corp., Casmalia	1,800	.....	S-A	
Five C Ref. Co., Santa Maria	2,500	.....	S-A	
Fletcher Oil Co., Inc., Wilmington	2,500	1,800	S-C	Dubbs
General Pet. Corp. of Calif., Torrance	60,000	19,000	S-C	Lummus, Vis. Breaking, Kellogg Reformer
General Pet. Corp. of Calif., Lebec	12,000	.....	S	
Gilmore Oil Co., Vernon	2,500	.....	S-A	
Golden Bear Oil Co., Oildale	2,000	.....	S-L-A	Vacuum
Hancock Oil Co. of Calif., Long Beach	12,500	5,000	S-C	W. T. Hancock
Harbor Ref. Co., Inc., Long Beach	2,500	.....	S	
Harbor Terminal Oil Co., Wilmington	1,500	.....	S	
Krieger Oil Co. of Calif., Clearwater	3,000	.....	S-A	
Macmillan Pet. Corp., Long Beach	8,000	.....	S	
Mercury Pet. Corp., Venice	2,500	.....	S-A	
Mohawk Pet. Co., Bakersfield	12,000	1,500	S-C-A	Own
Norwalk Co., Maricopa	5,000	.....	S	
Olympic Ref. Co., Long Beach	6,500	.....	S	
Operators Oil & Ref. Co., Long Beach	2,000	.....	S	
Pacific Central Ref. Co. Santa Maria	3,000	.....	S	
Pacific States Oil Co., Wilmington	7,000	3,500	S-C	Own
Palomar Ref. Co., Bakersfield	1,500	.....	S-L-A	
Paraffine Cos., Inc., Emeryville	1,500	.....	S-A	
Pathfinder Pet. Co., Los Alamitos†	.....	1,300	C	Own
Petrol Corp., Los Angeles	5,000	.....	S-A	
Richfield Oil Corp., Watson	80,000	52,000	Comp.	Sinclair, Black
Rothschild Oil Co., Santa Fe Springs	3,000	.....	S	
San Fernando Ref. Co., Newhall	2,500	.....	S-A	
Seaside Oil Co., Ventura	5,000	.....	S-A	
Shell Oil Co., Inc., Martinez	26,500	25,000	S-C-L-A	Dubbs-Own
Shell Oil Co., Inc., Oil Fields	7,000	.....	S	
Shell Oil Co., Inc., Wilmington	38,000	49,000	S-C-A	Dubbs
Silver Wing Ref. Co., Santa Maria	2,000	.....	S	
Socal Oil & Ref. Co., Huntington Beach	3,000	1,200	S-C	Dubbs
Standard Oil Co. of Calif., El Segundo	100,000	85,000	S-C-L-A	Dubbs
Standard Oil Co. of Calif., Richmond	100,000	56,000	S-C-L-A	Dubbs
Standard Oil Co. of Calif., Seguro	25,000	.....	S-A	
Texas Co. of Calif., Los Angeles	37,000	11,000	S-C	Holmes-Manley
Texas Co. of Calif., Fillmore	4,000	3,600	S-C	Cross
Tide Water Associated Oil Co., Avon	43,600	29,000	S-C-L-A	Tube & Tank
Tide Water Associated Oil Co., Watson	14,000	7,900	S-C	Vis. Breaking
Tiernan Ref. Co., Long Beach	1,500	.....	S-A	
Union Oil Co., Wilmington	57,000	¶5,500	S-C-A	Cross
Union Oil Co., Maltha	5,000	.....	S	
Union Oil Co., Oleum	§34,000	¶3,500	S-C-L-A	Union-Gasoline Prod.
Wilshire Oil Co., Inc., Norwalk	16,000	10,000	S-C	Dubbs
Yosemite Oil Ref. Co., Fruitvale	1,500	.....	S	
Total	810,700	386,900		

*Under construction.
†Cracking plant only.
§Includes 14,000 bbl. daily of effective throughput capacity of cracking plant.
¶Represents cracked gasoline output capacity of cracking units.

COLORADO

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Bay Pet. Corp., Denver	4,000	1,700	S-C	Dubbs
Continental Oil Co., Denver	2,700	1,500	S-C	Cross
Gramps Oil & Ref. Corp., Alamosa	1,250	700	S-C	Dubbs

COLORADO (Continued)

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Midland Oil Ref. Co., Denver	1,000	.....	S-A	
Oriental Ref. Co., Denver	2,000	.....	S	
Perry Pet. Co., Denver	1,500	.....	S	
Raven Oil & Ref. Co., Rangely	125	.....	S	
Texas Co., Craig	2,000	2,000	S-C	Holmes-Manley
Universal Refineries, Inc., Pueblo	1,000	.....	S	
Total	15,575	5,900		

DELAWARE

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Texas Co., Claymont	3,500	....	S-A	
Total	3,500	.....		

GEORGIA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Mexican Pet. Corp. of Georgia, Savannah	4,000	.....	S-A	
Total	4,000	.....		

IDAHO

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Gem State Ref. Co., Twin Falls	300	.....	S	
Idaho Ref. Co., Pocatello	2,000	1,250	S-C-A	T.V.P.
Total	2,300	1,250		

ILLINOIS

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Advance Ref. Co., Inc., Centralia	2,750	.....	S	
Allied Oil Corp. of Ill., St. Elmo	4,000	2,000	S-C	Own
Calumet Ref. Co., Burnham	1,200	.....	S-L	Schulze high vacuum
Cascade Ref. Co., Salem	3,000	.....	S	
Cross, Henry H. Co., Colmar	1,000	.....	S	
Cross, Henry H. Co., Dupo	1,000	.....	S	
Globe Oil & Ref. Co. (Ill.), Lemont	22,000	5,000	S-C	Winkler-Koch
Indian Ref. Co., Lawrenceville	25,000	15,000	Comp.	De Florez-Texas
Ohio Oil Co., Robinson	12,500	6,500	S-C-A	Holmes-Manley & Kellogg
Pana Ref. Co., Pana	4,000	1,600	S-C	Dubbs
Shell Oil Co., Inc., Wood River	75,000	63,000	S-C-L-A	Dubbs, Cross & T.V.P.
Socony-Vacuum Oil Co., Inc., E. St. Louis	16,000	12,800	S-C	Pratt vapor, Houdry
Standard Oil Co. (Ind.), Wood River	21,700	6,410	S-C-L-A	Holmes-Manley
Taxman Oil Co., Milan	2,500	.....	S	
Texas Co., Lockport	38,000	26,000	Comp.	Holmes-Manley De Florez Pressure Coke
Transport Oil & Ref. Co., Dupo	1,100	.....	S-A	
Wood River Oil & Ref. Co., Inc., Hartford	7,500	2,000	S-C	Winkler-Koch
B. F. Wireback, Colmar	500	.....	S	
Worth Ref. Co., Blue Island	7,000	2,000	S-C	
Total	245,750	142,310		

INDIANA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Cities Service Oil Co. (Del.), East Chicago	30,000	18,000	S-C	Doherty
Evansville Ref. Co., Evansville	2,000	.....	S	
Indiana Farm Bureau Coop. Assn., Inc., Mount Vernon	2,500	.....	S	
Johnson Oil Supply, Gary	1,500	.....	S	
Rock Island Ref. Corp., Indianapolis*	5,000	.....	S-C	
Sinclair Ref. Co., East Chicago	45,000	30,000	S-C-L-W	Sinclair 600
Socony-Vacuum Oil Co., Inc., E. Chicago	14,520	3,900	S-C	
Standard Oil Co. (Ind.), Whiting	119,000	47,700	Comp.	Holmes-Manley, Cross combination
Troy Ref. Corp., Troy	250	.....	S	
Total	219,770	99,600		

*Under construction.

KANSAS

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Bareco Oil Co., Wichita	6,000	2,500	S-C	Dubbs
Bay Pet. Corp., McPherson	4,500	2,500	S-C	Dubbs
Chanute Ref. Co., Chanute	.....	1,000	C	Jenkins
Cooperative Ref. Assoc., Phillipsburg	3,000	1,600	S-C	Dubbs
Derby Oil Co., Wichita	8,000	3,000	S-C-A	Dubbs
El Dorado Ref. Co., El Dorado	7,000	3,500	S-C	Winkler-Koch
Falcon Ref. Co., Great Bend	2,000	.....	S	
Globe Oil & Ref. Co., McPherson	15,000	3,000	S-C-L	Winkler-Koch
H. & T. Reclaiming & Ref. Plant, Chase	2,000	.....	S	
Kanotex Ref. Co., Arkansas City	12,000	4,000	S-C-A	Donnelly
National Ref. Co., Coffeyville	8,000	4,200	S-C	Dubbs
Petroleum Products Co., Chanute	1,800	1,000	S-C	Winkler-Koch
Phillips Pet. Co., Kansas City	23,000	12,000	S-C	Own-Dubbs
Shallow Water Ref. Co., Shallow Water	2,000	500	S-C-A	De Florez
Sinclair Ref. Co., Coffeyville	12,000	7,000	S-C-L-W	Sinclair 600
Sinclair Ref. Co., Kansas City	11,000	7,000	S-C	Sinclair 600
Skelly Oil Co., El Dorado	23,000	15,000	S-C-L-A	Winkler-Koch
Socony-Vacuum Oil Co., Augusta	23,000	20,000	S-C-A	Houdry and special
Standard Oil Co. (Ind.), Neodesha	7,400	2,640	S-C	Combination
Stockton Refinery, Stockton	500	.....	S	
Vickers Pet. Co., Potwin	4,000	2,000	S-C	Dubbs
Workman Oil & Ref. Co., McCune	100	.....	S	
Total	175,800	92,440		

KENTUCKY

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Aetna Oil Service, Inc., Louisville	9,000	3,000	S-C	Gasoline Prod.
Ashland Oil & Ref. Co., Catlettsburg	10,500	6,000	S-C-A	Dubbs
Greenville Ref. Co., Greenville	50	.....	S	
Louisville Ref. Co., Louisville	7,000	3,000	S-C-A	Dubbs
South Ky. Pipe Line Co., Somerset	400	.....	S	
Standard Oil Co. (Ohio), Latonia	12,000	4,600	S-C-A	Tube & Tank
Stoll Oil Ref. Co., Louisville	1,500	.....	S-L-W	
Texas Co., Pryse	4,000	3,000	S-C	Holmes-Manley
Tri-State Refineries, Inc., Spottsville	1,000	.....	S	
Total	45,450	19,600		

LOUISIANA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Arkansas Fuel Oil Co., Bossier City	23,000	17,000	S-C-L	Tube & Tank, La. Coil, Alco combination
Atlas Pipe Line Corp., Shreveport	9,000	4,500	S-C	Gyro
Bayou State Oil Corp., Hosston	800	.....	S-L-A	
Chalmette Pet. Corp., Chalmette	8,500	2,500	S-C	Cross comb.
Continental Oil Co., West Lake	8,000	4,000	S-C	Cross
Evangeline Ref. Co., Jennings	1,000	.....	S	
Evansville Oil Corp., Cotton Valley	1,200	.....	S	
General Oil Corp., Meraux	5,000	.....	S	
Pan American Pet. Corp., Destrehan	10.000	.....	S-A	
Premier Oil Ref. Co. of Tex., Cotton Valley	4,500	.....	S	
Princeton Ref. Corp., Princeton	500	.....	S-L-A	
Shell Oil Co., Inc., Norco	21,000	14,000	S-C-A	Dubbs
Standard Oil Co. of La., Baton Rouge	100,000	52,000	Comp.	Tube & Tank
Stanolind Oil & Gas Co., Superior	5,000	1,800	S-C	Cross
Total	197,500	95,800		

MARYLAND

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Continental Oil Co., Baltimore	7,500	3,500	S-C-A	Cross
Pan American Ref. Corp., Baltimore	8,000	.....	S-A	
Standard Oil Co. of N. J., Baltimore	27.000	48.000	S-C-L-A	Tube & Tank
Total	42,500	51,050		

MASSACHUSETTS

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Cities Service Oil Co. (Pa.), E. Braintree	20.000	18,000	Comp.	Cities Service
Colonial Beacon Oil Co., Everett	33,200	37,700	S-C-A	Tube & Tank
Total	53,200	55,700		

MICHIGAN

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Aurora Gasoline Co., Detroit	4,000	2,500	S-C	Dubbs

MICHIGAN (Continued)

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Aurora Gasoline Co., Elsie	3,000	.....	S	
Bay Ref. Corp., Bay City	4,400	.....	S	
Crystal Ref. Co. of Carson City, Inc., Carson City	3,000	.....	S	
Essex Ref. Co., Bay City	2,000	.....	S	
Fort Dale Oil & Ref. Co., Bloomingdale	1,500	.....	S	
General Ref. Co., Grand Haven	750	.....	S	
Independent Ref. Co. of Mich., Flat Rock	1,450	1,000	S-C	McKee V.P.
Keystone Oil Ref. Co., Detroit	2,500	.....	S	
Lakeside Ref. Co., Kalamazoo	2,000	.....	S	
Leonard Refineries, Inc., Alma	3,000	1,200	S-C-A	Dubbs
Leonard Refineries, Inc., St. Louis	4,000	1,500	S-C-A	Dubbs
Marvel Ref. Co., Grand Rapids	2,000	.....	S	
Mid-West Refineries, Inc., Alma	3,000	1,800	S-C	Dubbs
Mid-West Refineries, Inc., Grandville	4,000	2,000	S-C	Dubbs
Naph-Sol Ref. Co., Muskegon	5,000	2,000	S-C	Dubbs
Old Dutch Ref. Co., Muskegon	4,500	1,500	S-C	T.V.P.
Peerless Oil Co., Saginaw	500	.....	S	
Producers Ref., Inc., West Branch	2,500	.....	S-A	
Pure Oil Co., Midland	3,300	.....	S	
Roosevelt Oil Co., Mount Pleasant	5,000	1,600	S-C	Kellogg
Socony-Vacuum Oil Co., Trenton	21,000	8,000	S-C	
Sweet Oil Ref. Co., Wyman	2,000	.....	S	
Titan Ref. Co., Plymouth	3,000	.....	S	
Trumbull Asphalt & Ref. Co., West Branch	*1,250	.....	S-A	Vacuum
Total	88,650	23,100		

*Reduced crude.

MINNESOTA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Northwestern Ref. Co., St. Paul Park	1,500	.....	S	
Purzone, Inc., Minneapolis	4,500	.....	S	
Total	6,000	.....		

MISSISSIPPI

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Paluxy Asphalt Co., Crupe*	2,500	.....	S	
Total	2,500	.....		

*Under construction.

MISSOURI

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Joplin Ref. Co., Joplin	500	.....	S	
Standard Oil Co. (Ind.), Sugar Creek	21,800	6,260	S-C-A	Holmes-Manley
Total	22,300	6,260		

The HILL-HUBBELL "FACTORY PROCESS" gives you the highest degree of PIPE PROTECTION!

This illustrates how the HILL-HUBBELL "factory process" applies Coating-and-Wrapping MECHANICALLY—INDOORS—in one operation. There are no risks due to inexperienced and careless workers.

The important thing in Coating-and-Wrapping STEEL PIPE is to have every square inch of surface PROPERLY PROTECTED. The method used in applying coating determines its effectiveness. The HILL-HUBBELL "factory process" gives the highest degree of PROTECTION because all work is done MECHANICALLY—INDOORS—which eliminates ALL the many hazards that field coating is subject to. The overall cost is no higher.

Buy STEEL PIPE Mill Coated - and - Wrapped at any of these Mills

Jones & Laughlin Steel Corp.
National Tube Company
Republic Steel Corporation
Spang Chalfant, Inc.
The Youngstown Sheet & Tube Company

Schematic Construction of Specification TAX-1

GENERAL PAINT CORPORATION
HILL, HUBBELL & CO. • Division • Cleveland, Ohio
• EXPORT OFFICE: SAN FRANCISCO, CALIFORNIA, U. S. A. •

MONTANA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Arro Oil & Ref. Co., Lewistown	1,000	500	S-C	Dubbs
Bears Den Refinery, Chester	50	.....	S	
Big West Oil Co. of Mont., Kevin	1,500	1,000	S-C	Dubbs
Bridger Refinery, Bridger	30	.....	S	
Carroll, L. Ray, Roundup	100	.....	S	
Continental Oil Co., Lewistown	1,225	.....	S	
Cut Bank Ref. Co., Cut Bank	1,100	400	S-C	Own
Gallatin Valley Co-Operative Co., Belgrade	350	.....	S	
Gallup City Refinery, Gallup City	150	.....	S	
Glacier Prod. Co., Cut Bank	3,500	2,500	S-C	Dubbs
Hannah-Porter Co., Sweet Grass	350	.....	S	
Hart Refineries, Missoula	300	300	S-C	Own
Hole Bros. Refinery, Cut Bank	400	.....	S	
Home Oil & Ref. Co., Great Falls	1,500	1,200	S-C-A	Dubbs
Hunt, Eugene, Winnett	400	.....	S	
Independent Ref. Co., Laurel	4,000	2,000	S-C-A	Dubbs
Morton Refinery, Oilmont	200	.....	S	
North American Ref. Co., Chinook	500	.....	S	
Northwest Ref. Co., Cut Bank	3,800	1,000	S-C	Dubbs
Pondera Valley Refinery, Pondera field	75	.....	S	
Production Ref. Corp., Shelby	2,500	.....	S	
Sandgren & Nyhagen, Cut Bank	35	.....	S	
Sun River Refinery (Manchester), Great Falls	100	.....	S	
Sweet Grass Oil & Ref. Co., Sweet Grass	600	.....	S	
Texas Co. (Internat'l Ref. Co.), Sunburst	7,000	6,000	S-C	De Florez
Treasure State Ref. Co., Shelby	350	.....	S	
Unity Pet. Corp., Kalispell	800	300	S-C	Vapor Phase
Whitlash Ref. Co., Whitlash	30	.....	S	
Yale Oil Corp., Billings	8,000	.....	S-L-A	
Yale Oil Corp., Kalispell	1,000	.....	S	
Total	40,945	15,200		

NEBRASKA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Carpenter, Terry, Inc., Scottsbluff	1,200	600	S-C	Dubbs
Gordon Ref. Co., Gordon	100	.....	S	
Mid-States Ref. Co., Falls City	3,000	.....	S	
Petroleum Utilities Co., Inc., Chadron	750	.....	S	
Porter Oil Co., Sidney	300	.....	S	
Searle Pet. Co., Omaha	1,000	.....	S	
Total	6,350	600		

NEW JERSEY

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Barber Asphalt Corp., Barber	13,500	3,000	S-C-A	Cross
Cities Service Oil Co. (Pa.) (Petty Island), Camden	20,000	20,000	S-C	Cities Service
Cities Service Oil Co. (Pa.), Linden	12,000	.....	S-A	
Socony-Vacuum Oil Co., Paulsboro	25,200	2,900	S-C-L-W	
Standard Oil Co. of N. J., New Jersey Works (Bayonne, Linden, Jersey City)	124,000	105,000	Comp.	Tube & Tank
Tide Water Associated Oil Co., Bayonne	57,000	21,000	S-C-L-W	Tube & Tank
Total	251,700	151,900		

NEW MEXICO

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Aerex Co., Bloomfield	100	.....	S	
Basin Ref. Co., Aztec	100	.....	S	
Continental Oil Co., Artesia	1,500	640	S-C	Cross
Continental Oil Co., Farmington	750	.....	S	
Malco Refineries, Inc., Artesia	2,000	1,000	S-C	Dubbs
McNutt Oil & Ref. Co., Brickland	1,200	600	S-C	Donnelly
Petroleum Products Ref. Co., Prewitt	1,500	1,000	S-C	Own
Southwestern Oil & Ref. Co., Artesia	300	.....	S	
Valley Ref. Co., Roswell	1,200	700	S-C-A	Dubbs
Total	8,650	3,940		

NEW YORK

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Allegany Refineries, Inc., Bolivar	1,200	.....	S	
Frontier Fuel Oil Corp., Buffalo	7,500	2,000	S-C	
Gulf Oil Corp., Staten Island	13,000	.....	S	
Sinclair Ref. Co., Wellsville	10,000	6,000	S-C-L-W	Sinclair 600
Socony-Vacuum Oil Co., Brooklyn and Long Island City	19,000	5,200	Comp.	
Socony-Vacuum Oil Co., Buffalo	14,500	7,200	Comp.	
Socony-Vacuum Oil Co., Olean	6,500	.....	S-L-W	
Total	71,700	20,400		

OHIO

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Canfield Oil Co., Cleveland	1,500	.....	S	
Canton Ref. Co., Canton	6,000	3,000	S-C	Dubbs
Gulf Ref. Co., Cleves	18,000	8,000	S-C-A	Gulf
Gulf Ref. Co., Toledo	18,000	7,000	S-C	Gulf
National Ref. Co., Findlay	6,000	3,200	Comp.	Dubbs
Pure Oil Co., Newark	12,400	9,300	S-C	Cross
Pure Oil Co., Toledo	18,700	14,000	S-C	Cross
Standard Oil Co. (Ohio), Cleveland	23,000	9,000	Comp.	Tube & Tank
Standard Oil Co. (Ohio), Lima	9,000	3,000	S-C	Solar
Standard Oil Co. (Ohio), Toledo	21,000	7,200	S-L-W	Kellogg combination
Sun Oil Co., Toledo	25,000	13,000	S-C	Own-Houdry
Total	158,600	76,700		

OKLAHOMA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Allied Materials Corp., Stroud	1,500	.....	S-A	
Anderson-Prichard Ref. Corp., Cyril	8,000	5,000	S-C-A	Winkler-Koch
Bareco Oil Co., Barnsdall	5,000	2,700	S-C-L-W	Cross
Bell Oil & Gas Co., Grandfield	4,500	2,500	S-C	Dubbs
Ben Franklin Ref. Co., Ardmore	4,500	2,800	S-C	Dubbs
Black Gold Ref. Co., Oklahoma City	2,000	1,000	S-C	Dubbs
Champlin Ref. Co., Enid	15,000	4,000	S-C-L-W	Own
Cities Service Oil Co. (Del.), Ponca City	12,000	4,500	Comp.	Dubbs-Doherty
Continental Oil Co., Ponca City	26,000	11,000	S-C-L-W	Cross
Cosco Oil Co., Wynnewood	2,500	1,750	S-C-A	Dubbs
Cushing Ref. & Gaso. Co., Cushing	4,500	2,000	S-C	Dubbs
Deep Rock Oil Corp., Cushing	10,000	5,000	Comp.	Dubbs

OKLAHOMA (Continued)

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Johnson Oil Ref. Co., Cleveland	5,000	2,750	S-C	Dubbs
Mid-Continent Pet. Corp., West Tulsa	40,000	20,000	Comp.	Own
Monarch Refineries, Inc., Oklahoma City	1,500	.....	S-A	
Peppers Gasoline Co., Oklahoma City	500	.....	S	
Phillips Pet. Co., Okmulgee	6,000	1,500	S-C-L	Dubbs
Rock Island Ref. Co., Beckett	7,500	4,000	S-C-A	Winkler-Koch
Shale Oil Co., Lawton	80	.....	S	
Sinclair Ref. Co., Sand Springs	6,000	3,000	S-C-L-W	Cross
Sun Oil Co., Yale	5,000	.....	S	
Sunray Oil Co., Allen	8,200	4,000	S-C-A	Dubbs
Texas Co., West Tulsa	18,000	12,000	Comp.	Holmes-Manley
Tide Water Associated Oil Co., Drumright	12,000	4,500	S-C	Tube & Tank
Wilcox, H. F., Oil & Gas Co., Bristow	5,000	2,300	S-C	Dubbs
Total	210,280	96,300		

PENNSYLVANIA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Atlantic Ref. Co., Philadelphia	90,000	25,300	Comp.	Lewis, Cross, De Florez Combination
Berry, James B., Sons Co., Inc., Oil City	2,500	700	Comp.	Dubbs
Bradford Penn Ref. Corp., Clarendon	2,000	.....	S-L-W	
Canfield Oil Co., Coraopolis	1,500	.....	S	
Cities Service Oil Co. (Pa.), Titusville	3,000	.....	S-L-W	
Conewango Ref. Co., Warren*		.....	L	
Continental Ref. Co., Oil City	1,000	500	S-C-L-W	Dubbs
Daugherty Ref., Petrolia	2,000	.....	S-L	
Franklin Creek Ref. Corp., Franklin	2,000	.....	S-L	
Freedom Oil Co., Freedom	3,000	750	S-C-L-W	Dubbs
Gulf Oil Corp., Philadelphia	40,000	12,000	S-C-L	Gulf
Gulf Oil Corp., Pittsburgh	10,000	3,000	S-C-L	Gulf
Kendall Ref. Co., Bradford	4,000	2,200	S-C-L-W	Dubbs
Oil Creek Ref. Co., Titusville	1,600	.....	S-L-W	
Penna. Oil Prod. Ref. Co., Eldred	3,000	500	Comp.	Own
Pennsylvania Ref. Co., Karns City	1,800	.....	S-L-W	
Pennsylvania Ref. Co., Titusville	1,500	.....	S-L-W	
Pennzoil Co., Oil City		7,000	C	Dubbs
Pennzoil Co., Rouseville	10,000	.....	S-L-W	
Quaker State Oil Ref. Corp., Emlenton	2,000	1,000	S-C-L-W	Dubbs
Quaker State Oil Ref. Corp., Farmers Valley	4,000	1,250	S-C-L-W	Dubbs
Sherwood Ref. Co., Warren	800	.....	S	
Sinclair Ref. Co., Marcus Hook	45,000	30,000	S-C-A	Sinclair 600
Sun Oil Co., Marcus Hook	90,000	38,500	S-C-L-A	Own-Houdry
Superior Oil Works, Warren	500	.....	S-L-W	
Ultra-Penn Ref. Co., Bruin	1,000	.....	S-L	
United Ref. Co., Warren	5,500	2,000	S-C-L-W	Dubbs
Valvoline Oil Co., Butler	3,000	.....	S-L-W	
Waverly Oil Works Co., Pittsburgh	1,500	.....	S-L-W	
Wolf's Head Oil Ref. Co., Inc., Reno†	2,500	5,000	S-C-L-W	Dubbs
Total	334,700	129,700		

*Management taken over by Sinclair Refining Co.
†Cracking plant operated under joint ownership of Pennzoil, Quaker State and Continental Ref. Co.

RHODE ISLAND

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Socony-Vacuum Oil Co., Inc., Riverside	9,000	1,650	S-C-A	
Texas Co., Providence	3,500	.....	S-A	
Total	12,500	1,650		

SOUTH CAROLINA

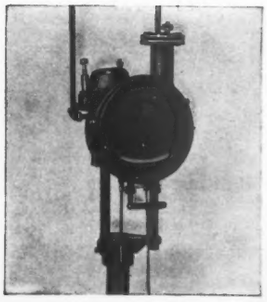
Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Standard Oil Co. of N. J., Charleston	6,000	.....	S-A	
Total	6,000	.....		

SOUTH DAKOTA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Belle Refining Co., Belle Fourche	50	.....	S	
Hot Springs Ref. Co., Hot Springs	180	.....	S	
Rex Oil Refinery, Rapid City	200	.....	S	
Sturgis Ref. Co., Sturgis	100	.....	S	
Total	530	.....		

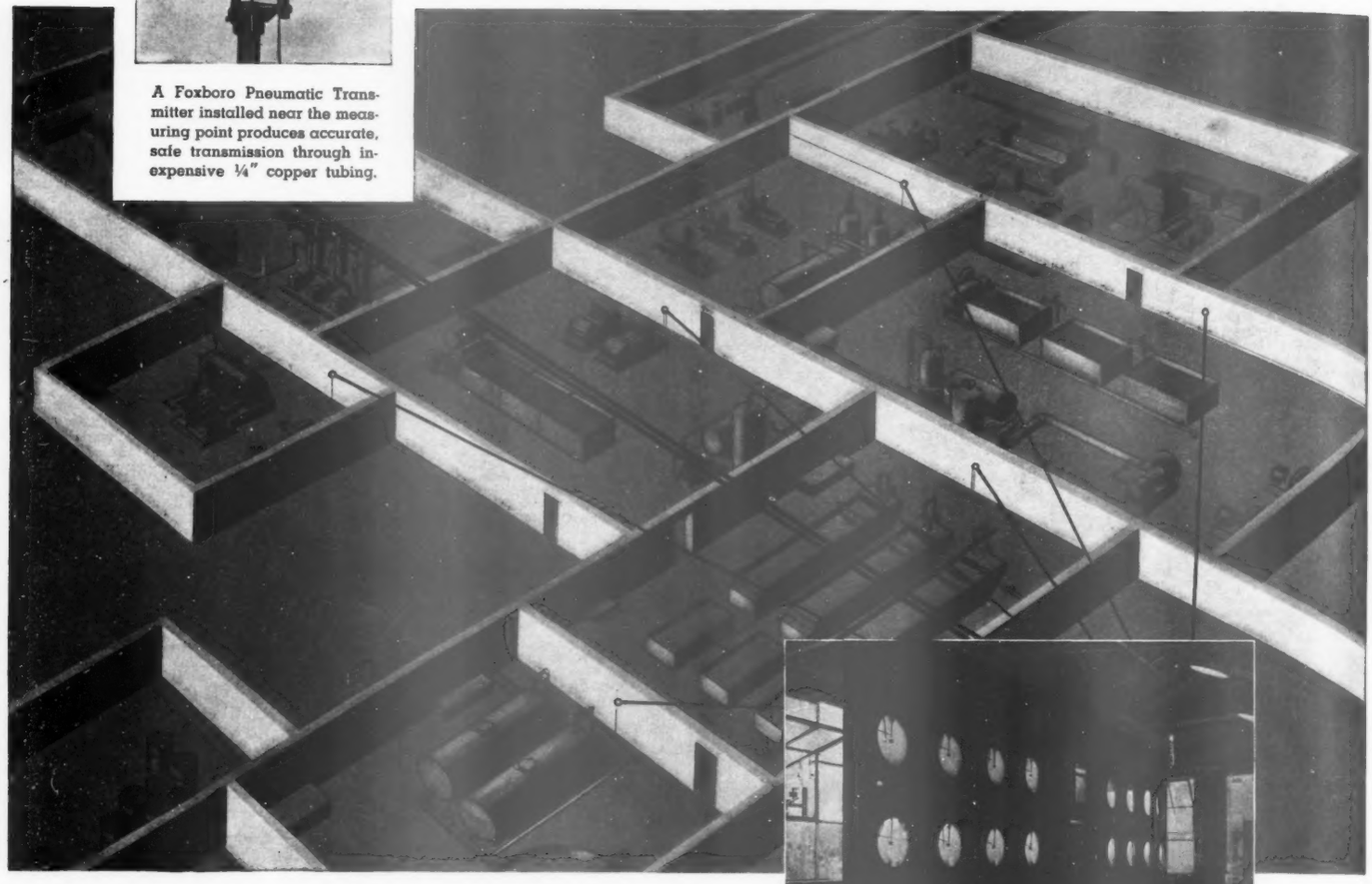
TEXAS

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Aero Gas Ref. Co., Fort Stockton	500	.....	S	
American Pet. Co., Houston	10,000	.....	S	
Amsco Ref. Co., Corpus Christi	12,000	.....	S	
Atlantic Ref. Co., Atreco	20,600	8,000	S-C	Combination
Baird Ref. Co., Baird	1,500	800	S-C	Own
Beacon Oil & Ref. Co., Henderson	4,500	.....	S	
Bryson Pipe Line & Ref. Co., Bryson	1,500	200	S-C-L	
Bryson Pipe Line & Ref. Co., Dallas	1,500	.....	S	
Bryson Pipe Line & Ref. Co., Gainesville	1,800	.....	S	
Coastal Refineries, Inc., Port Isabel	7,000	.....	S	Rowsey Vis. Breaking
Coleman Ref. Co., Coleman	600	.....	S	
Col-Tex Ref. Co., Colorado City	12,000	4,000	S-C-A	Dubbs
Continental Oil Co., Wichita Falls	5,000	2,600	S-C	Cross
Cosden Pet. Corp., Big Spring	16,000	13,000	S-C	Dubbs
Cosden Pet. Corp., Graham	3,000	.....	S	
Crown Central Pet. Corp., Houston	16,000	6,000	S-C-L	Holmes-Manley
Danciger Oil & Refineries, Inc., Pampa	7,000	4,000	S-C	
Danube Oil Corp., Borger	1,000	500	S-C	
Eastern States Pet. Co., Inc., Houston	20,000	15,000	S-C	Comb.
Gladewater Ref. Co., Gladewater	3,000	2,000	S-C	Own
Gratex Ref. & Fuel Oil Co., Graham	500	.....	S	
Gulf Oil Corp., Fort Worth	6,000	3,000	S-C	Gulf
Gulf Oil Corp., Port Arthur	130,000	50,000	S-C-L-W	Gulf
Gulf Oil Corp., Sweetwater	6,000	2,500	S-C	Gulf
Hammon Exploration Co., Bay City	3,000	.....	S	
Heffington Pet. Co., Austin	200	.....	S	
Houston Oil Co. of Tex., Viola	500	.....	S	
Humble Oil & Ref. Co., Baytown	150,000	90,000	S-C-L-A	Tube & Talk, Cross
Humble Oil & Ref. Co., Ingleside	30,000	18,500	S-C	Tube & Tank
Humble Oil & Ref. Co., Neches	5,000	.....	S	
Humble Oil & Ref. Co., San Antonio	5,000	.....	S	
Independent Ref. Co., Arp	3,500	3,500	S-C	Own
Jacksboro Ref. Co., Jacksboro	250	.....	S	
Lacy, Roger, Refinery, Kilgore	2,500	1,000	S-C	
La Salle Pet. Corp., Burkburnett	2,500	.....	S	
Lynch Ref. Co., Kilgore	5,000	2,000	S-C	Own



A Foxboro Pneumatic Transmitter installed near the measuring point produces accurate, safe transmission through inexpensive ¼" copper tubing.

AS FLEXIBLE AS AIR!



PNEUMATIC TRANSMISSION *by Foxboro*

A typical installation of Foxboro Recording and Controlling Instruments operated safely and accurately by air pressure supplied by remote Transmitters.

Centralized instrumentation of industrial plants is brought to its highest and most useful stage in Foxboro Pneumatic Transmission Systems! Measurement and control operations now can be carried to any convenient location up to 1000 feet from the measuring point, without *long* lead lines . . . without lead-lines at high pressure or temperature . . . and with complete freedom from fire and explosion hazards.

Flexibility in these systems is unequalled by remote transmission systems employing any other medium. For instance, several recorders, controllers or indicators at different points may be linked to a single transmitter, with no loss in accuracy. Or, for other special requirements, a single receiving instrument may be used to correlate the measurements of several transmitters.

The development of these improved remote control systems is a typical example of Foxboro *Creative Instrumentation* . . . basic engineering that produces, not only advanced instrument design, but also better application of instruments to the individual problems of every industry.

Write for details of Foxboro Pneumatic Transmission in Bulletin 227. **The Foxboro Co., 60 Neponset Ave., Foxboro, Mass., U. S. A.** Branches in principal cities of U. S. and Canada.

RECORDING • CONTROLLING • INDICATING

FOXBORO
REG. U. S. PAT. OFF.
Instrumentation

TEXAS (Continued)

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
McBride Ref. Co., Inc., La Blanca (Edinburg)	1,200	.....	S	
Magnolia Pet. Co., Beaumont	100,000	58,000	S-C-L-W	Houdry, Cross
Magnolia Pet. Co., Corsicana	5,000	.....	S	
Magnolia Pet. Co., Fort Worth*	5,800	3,500	S-C	Cross
Maritime Oil Co., Houston	5,000	.....	S	
Mertzon Ref. Co., Mertzon	200	.....	S	
Minerva Ref. Co., Minerva	1,250	.....	S	
Motor Fuels Corp., Levelland	3,200	1,700	S-C	Dubbs
Moutray Oil Co., Hawley	1,250	.....	S	
Nueces Ref. Co., Clarkwood	2,500	.....	S	
North Texas Ref. Co., Inc., Gainesville	600	.....	S	
Ohio Oil Co., Fort Worth	4,500	1,500	S-C-L-W	Kellogg
Olney Oil & Ref. Co., North Olney	2,000	1,500	S-C	Donnelly
Onyx Ref. Corp., Abilene	2,000	350	S-C	Own
Pan American Ref. Corp., Texas City	97,000	79,000	S-C	Combination
Panhandle Ref. Co., Lueders	1,500	600	S-C	Dubbs
Panhandle Ref. Co., Wichita Falls	4,000	1,600	S-C	Dubbs
Payward Ref. Co., Shamrock	1,000	.....	S	
Pettus Oil & Ref. Co., Pettus	1,000	.....	S	
Phillips Pet. Co., Borger	35,000	17,000	S-C	Own
Phillips Pet. Co., Penwell	1,000	750	S-C	Own
Phoenix Ref. Co., Houston	2,500	.....	S	
Phoenix Ref. Co., San Antonio	3,000	1,000	S-C	
Pioneer Oil & Ref. Co., Somerset	1,400	.....	S-L-A	
Pontiac Ref. Corp., Corpus Christi	10,500	.....	S	
Post Ref. Co., Rotan	800	.....	S	
Premier Oil Ref. Co. of Tex., Willow Spgs.	4,000	2,000	S-C	Own
Pure Oil Co., Nederland	48,300	27,100	S-C	Cross
Rado Ref. Co., McAllen	1,000	.....	S	
Refugio Ref. Co., Refugio	1,000	.....	S	
Republic Oil Ref. Co., Texas City	20,000	6,000	S-C	Winkler-Koch
Shamrock Oil & Gas Corp., Sunray	3,500	1,800	S-C	Dubbs
Shell Oil Co., Inc., Houston	74,000	52,000	S-C	Dubbs
Shelly Ref. Co., Bay City	1,200	600	S-C	Own
Sinclair Ref. Co., Fort Worth	4,000	3,000	S-C	Sinclair 600
Sinclair Ref. Co., Houston	60,000	44,000	S-C-L-W	Sinclair 600
Southland Ref. Co., Olney	500	.....	S	
Southport Pet. Co. of Del., Texas City	20,000	20,000	Comp.	
Southwestern Oil & Ref. Co., Corpus Christi	15,000	.....	S	
Standard Oil Co. of Texas, El Paso	14,000	5,000	S-C	Dubbs
Star Light Ref. Co., Inc., Ballinger	600	.....	S	
Stone Oil Co., Texas City	7,500	.....	S	
Sunshine Refinery, Livington	400	.....	S	
Talco Asphalt & Ref. Co., Mount Pleasant	8,500	3,000	S-C-A	Dubbs
Taylor Ref. Co., Corpus Christi	22,500	.....	S	Rowsey Vis. Breaking
Taylor Ref. Co., Taylor	2,000	.....	S	Rowsey Vis. Breaking
Terminal Ref. Corp., Corpus Christi	12,000	.....	S	
Texas Co., Amarillo	7,000	4,000	S-C	De Florez Pressure Coke
Texas Co., El Paso	2,000	2,000	S-C	Holmes-Manley
Texas Co., Houston	25,000	2,500	S-C	Tube & Tank
Texas Co., Port Arthur	135,000	107,000	Comp.	Holmes-Manley, De Florez, Pressure Coke
Texas Co., Port Neches	40,000	.....	S-A	
Texas Co., San Antonio	5,500	5,500	S-C	Holmes-Manley
Texas Co., West Dallas	15,000	14,000	S-C	Holmes-Manley, De Florez, Pressure Coke
Texas Pacific Coal & Oil Co., Caddo	400	.....	S	
Three Rivers Ref., Three Rivers	2,500	.....	S-L-A	
Tydal Ref. Co., Gainesville	2,000	.....	S	
Uvalde Rock Asphalt Co., Blewett	500	.....	S	
Valley Ref. Co., Harlingen	1,000	.....	S	
Waggoner, W. T., Estate, Electra	4,000	2,000	S-C	Dubbs
Western Ref. Co., Fort Stockton	1,000	.....	S	
Wickett Ref. Co., Wickett	4,000	.....	S	
Total	1,352,550	694,600		

*Plant will be increased to crude capacity of 20,000 bbl. when combination unit under construction is completed.

UTAH

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Equity Oil Co., Vernal (Jensen)*	1,000	.....	S	
Utah Oil Ref. Co., Salt Lake City	8,000	7,200	Comp.	Modified Holmes-Manley Vapor Phase
Wasatch Oil Ref. Co., Woods Cross	2,000	1,500	S-C	
Total	11,000	8,700		

*Building.

VIRGINIA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Texas Co., Norfolk	2,000	.....	S-A	
Total	2,000	.....		

WASHINGTON

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Inland Empire Refineries, Inc., Spokane	2,500	1,500	S-C-A	Winkler-Koch
Montana Headlight Oil Co., Spokane	800	.....	S-A	
Total	3,300	1,500		

WEST VIRGINIA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Carbide & Carbon Chemicals Corp., S. Charleston	2,000	2,000	S-C	Gyro
Elk Refining Co., Falling Rock	3,000	1,000	S-C-L-W	Dubbs
Pure Oil Co., Cabin Creek	4,200	2,800	S-C-L-W	Gyro
Quaker State Oil Ref. Corp., St. Marys	2,500	1,000	S-C-L-W	Dubbs
Total	11,700	6,800		

WISCONSIN

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Wisconsin Oil Ref. Co., Inc., Sheboygan	5,000	.....	S	
Total	5,000	.....		

WYOMING

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Albany Oil & Ref. Co., Laramie	200	.....	S	
Beck Refinery, Cody	500	.....	S	
C. & H. Refinery, Lusk	100	.....	S	
Continental Oil Co., Glenrock	2,800	1,800	S-C	Cross
Consumers Oil & Ref. Co., Newcastle	1,200	.....	S	
Crook County Refinery, Sundance	100	.....	S	
Davis Oil Co., Newcastle	75	.....	S	
Douglas Ref., Douglas	120	.....	S	
Elk Horn Gas Refinery, Osage	55	.....	S	
Empire State Oil Co., Thermopolis	1,500	.....	S-A	
Frontier Ref. Co., Cheyenne	1,500	*750	S-C	
Gray Refinery, Inc., Newcastle	1,000	.....	S	
Husky Ref. Co., Cody	2,500	.....	S	
Independent Refinery, Lusk	300	150	S	
Moorcroft Ref. Co., Moorcroft	65	.....	S	
North La Barge Oil Co., La Barge	125	.....	S	
Northwestern Pet., Osage	100	.....	S	
Ohio Oil Co., Lovell	2,500	.....	S-A	
Pilot Oil Co., Morton	250	200	S-C	Own
Ralston Refinery, Upton	50	.....	S	
Resolute Oil Corp., Badger Basin	1,000	500	S-C	Own
Silver Tip Refinery, Yoder	90	.....	S	
Sinclair Ref. Co., Parco	8,000	7,000	S-C	Sinclair 600
Socony-Vacuum Oil Co., Inc., Casper	3,000	2,000	S-C-A	Special
Standard Oil Co. (Ind.), Casper	13,600	3,800	Comp.	Vapor Phase
Standard Oil Co. (Ind.), Greybull	4,400	1,000	S-C-A	Cross
Texas Co., Casper	7,000	7,200	S-C	Holmes-Manley, Pressure Coke
Texas Co., Cody	3,000	.....	S-A	
Tri-State, Inc., Thermopolis	1,000	.....	S	
Upton Refinery, Upton	110	.....	S	
Wheatco Ref. Co., Wheatland	120	.....	S	
Yale Oil Corp., Lovell	1,000	.....	S-A	
Yale Oil Corp., Worland	600	.....	S	
Z & W Service & Refinery, Torrington	65	.....	S	
Total	58,025	24,400		

*Under construction.

Shutdown Plants in United States

CALIFORNIA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Aromalene, Inc., Long Beach	1,800	.....	S	
Atlas Ref. Co., N. Long Beach	1,500	.....	S	
Bush, R. R., Oil Co., Long Beach	3,400	.....	S	
California Oil & Ref. Co., N. Long Beach	3,000	.....	S	
Cascade Oil & Ref. Co., Venice	3,000	.....	S	
Cascade Oil & Ref. Co., Bandini	2,000	.....	S	
Cascade Oil & Ref. Co., Torrance	1,500	.....	S	
East-West Ref. Co., Los Angeles	3,000	.....	S	
Estado Pet. Corp., Long Beach	9,000	.....	S	
General Pet. Corp. of Calif., Vernon	28,000	.....	S	
Gilmore Oil Co., Roadamite (Santa Maria)	1,500	.....	S-A	
Hynes Ref. Co., Hynes	1,500	.....	S	
Industrial Oil & Ref. Co., Southgate	500	.....	S-L	
Interstate Oil Corp., Taft	250	.....	S	
Kern Oil Co., Ltd., Pico	4,000	.....	S	
Kolingo Ref. Co., Coalinga	300	.....	S-A	
Mangold & Tweedy Ref. Co., Long Beach	2,000	.....	S	
McCallem Ref. Co., McCallem	4,000	.....	S	
New Santa Maria Ref. Co., Santa Maria	1,500	.....	S	
Pan Pacific Oil Co., Long Beach	2,500	.....	S	
Petco Ref. Co., Santa Maria	9,500	.....	S-A	
Rice Ranch Oil Co., Santa Maria	500	200	S-C	Clark T.V.P.
Richfield Oil Corp., Hynes	55,000	14,000	S-C	Cross
Richfield Oil Corp., Vinvale	10,000	3,600	S-C	Sinclair
Seaside Oil Co., Summerland	1,000	.....	S	
Signal Hill Ref. Co., Long Beach	3,500	.....	S	
Solvents Ref. Co., Vinvale	750	.....	S	
Stockton Oil Co., Stockton	2,000	.....	S	
Tracy Development Corp., Maricopa	1,200	.....	S	
Walter Steiner Ref. Co., Long Beach	2,000	.....	S	
Total	159,700	17,800		

ILLINOIS

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Basin Oil Ref. Co., Centralia	2,000	.....	S	
Central Illinois Oil & Ref. Co., Centralia	1,500	.....	S	
Centralia Ref. Co., Centralia	2,000	.....	S	
Egyptian Prod. & Ref. Co., Centralia	2,000	.....	S	
Fairfield Ref. Corp., Fairfield	1,800	.....	S	
Goodson Oil Co., Inc., Sandoval	1,200	.....	S	
H.S.&B. Ref. Co., Mill Shoals	1,200	.....	S	
Lake Ref. Co., Salem	2,000	.....	S	
Total	13,700	.....		

KANSAS

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Anco Ref. Co., Garrett	450	.....	S	
Krueger Oil & Ref. Co., Natoma	150	.....	S	
Roper Pet. Co., Parsons	750	.....	S	
Total	1,350	.....		

LOUISIANA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Rodessa Oil & Ref. Corp., Cedar Grove	10,000	6,000	S-C	Forward Proc.
Shoreline Oil Co., Shoreline	5,000	2,200	Comp.	
Total	15,000	8,200		

MISSISSIPPI

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Johnson, E. C., Co., Vicksburg	4,000	.....	S	
Total	4,000	.....		

MICHIGAN

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Caro Refineries, Inc., Caro	1,000	.....	S	
Hi-way Ref. Co., Vernon (Rosebud)	500	.....	S	
Mid-West Refineries, Inc., Grand Rapids	2,000	.....	S	
Mid-West Refineries, Inc., Dewey	1,500	.....	S	
Sovereign Ref. Co., Saginaw	1,200	.....	S	
Trumbull Asphalt & Ref. Co., Alma	*1,500	.....	S.A.W.	Vacuum
Total	7,700	.....		

*Reduced crude.

MONTANA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Deloraine Ref. Co., Ollmont	225	.....	S	
Home Oil & Ref. Co., Conrad	600	.....	S	
Lake County Refinery, Polson	100	.....	S	
Russell Oil Co., Billings*	1,000	.....	S	
Russell Oil Co., Butte*	500	.....	S	
Total	2,425	.....		

*Leased by Independent Ref. Co.

NEW JERSEY

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Seaboard Ref. Co., Piscataway	6,000	.....	S	
Total	6,000	.....		

NEW MEXICO

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Pecos Diamond Ref. Co., Inc., Artesia	325	.....	S	
San Juan Oil & Ref. Co., Farmington	400	.....	S	
Tyreco Ref. Co., Artesia	2,000	.....	S	
Total	2,725	.....		

OHIO

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Johnson, A. L., Wayne	65	.....	S	
Montgomery, H. A., Co., Inc., Findlay	500	.....	S-L-A	
Panda Oil & Ref. Co., Toledo	3,500	.....	S-A	
Total	4,065	.....		

OKLAHOMA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Cities Service Oil Co. (Del.), Okmulgee	4,000	1,200	S-C-L-W	Doherty
Eason Oil Co., Enid	5,000	.....	S	
Globe Oil & Ref. Co. (Okla.), Blackwell	8,000	4,000	S-C	Winkler-Koch
Knox Ref. Co., Covington	500	.....	S	
Omar Ref. Co., Garber	5,000	2,000	S-C	
Pilgrim, Inc., Kingston	50	.....	S-L	
Total	22,550	7,200		

PENNSYLVANIA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Bradford Oil Ref. Co., Bradford	2,500	900	S-C-L-W	T.V.P.
Total	2,500	900		

TENNESSEE

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Russell Producing Co., Sunbright	150	.....	S	
Total	150	.....		

TEXAS

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Allstate Ref. Co., Thrall	2,500	.....	S	
Bareco Oil Co., Corpus Christi	10,000	5,500	S-C	Dubbs
Delta Ref. Co., Sullivan City	500	.....	S	
East Texas Ref. Co., Longview	10,000	5,000	S-C	Donnelly
Falls Ref. Co., Inc., Wichita Falls	2,500	.....	S	
Howard County Ref. Co., Big Spring	2,000	.....	S	
Hurricane Pet. Corp., Arp	3,000	1,800	S-C	Sinclair
Hurricane Pet. Corp., Overton	5,000	3,000	S-C	Sinclair
McMurrey Ref. Co., Tyler	6,000	3,000	S-C	Dubbs
Medina Valley Ref. Co., Hondo	100	.....	S	
Muenster Ref. Co., Muenster	1,500	.....	S	
Phoenix Ref. Co., Waco	1,500	.....	S	
Rusk Oil & Ref. Co., Overton	3,500	.....	S	
Russell Oil Co., San Antonio	750	.....	S	
Tucker Oil Co., Burkburnett	250	.....	S	
Total	49,100	18,300		

UTAH

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Baker Pet. Corp., Virgin*	200	.....	S	
Total	200	.....		

*Leased from Diamond Oil Co.

WYOMING

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Henderson, J. A., Powell	25	.....	S	
Salt Creek Refinery, Columbine (Casper)	200	.....	S	
Texas Co. (Del.), Calpet*	350	.....	S	
Whitman, A. J., Leroy	200	.....	S	
Total	775	.....		

*To resume operation in May 1941.

Operating Refineries in Canada

ALBERTA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Becker Refineries, Ltd., Royalties	500	.....	S	
British American Oil Co., Ltd., Calgary	5,000	2,500	S-C-A	Winkler-Koch
Comet Ref. Co., Ltd., Red River*	250	.....	S	
Dina Oil & Ref. Co., Ltd., Dina	500	.....	S	
Fraser, J. W., Ref. Co., Wainwright	100	.....	S	
Gas & Oil Products, Ltd., Hartell	2,500	600	S-C	Dubbs
Gold Standard Oils, Ltd., Wainwright	300	.....	S-A	
Hi-Way Refineries, Ltd., South Edmonton*	500	.....	S	
Huff Ref. Co., Ltd., Lethbridge	500	.....	S	
Imperial Oil, Ltd., Calgary	7,500	4,400	S-C-L-A	Tube & Tank
Lion Ref. Co., Calgary	1,500	.....	S	
Munro, J. R., Hubalta	500	.....	S	
Okotoks Oil & Ref. Co., Ltd., Okotoks	300	.....	S	
Shaw Petroleums, Ref. Div., Lloydminster†	750	500	S-C-A	
Warner Oil Ref. & Dist. Co., Warner	500	.....	S	
Total	21,200	8,000		

*Shut down. †Under construction.

BRITISH COLUMBIA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Home Oil Distributors, Ltd., N. Vancouver*	1,000	.....	S	
Imperial Oil, Ltd., Ioco	16,000	3,400	S-C-L-A	Tube & Tank
Shell Oil Co. of B. C., Shellburn	4,200	.....	S	
Standard Oil Co. of B. C., Ltd., Vancouver	4,300	.....	S	
Total	25,500	3,400		

*Shut down.

MANITOBA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Anglo-Canadian Oils, Ltd., Brandon	1,400	500	S-C-A	Dubbs
Carman Oil Ref., Ltd., Carman*	250	.....	S	
Mid-West Refineries, Ltd., Dauphin	200	.....	S	
North Star Oil, Ltd., Winnipeg	1,500	600	S-C	Dubbs
Radio Oil Ref., Ltd., Kildonan	500	.....	S	
Total	3,850	1,100		

*Shut down.

NEW BRUNSWICK

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
New Brunswick Gas & Oilfields, Ltd., Weldon	300	.....	S	
Total	300	.....		

NORTHWEST TERRITORY

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Northwest Co., Ltd., Fort Norman	850	.....	S	
Total	850	.....		

NOVA SCOTIA

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Imperial Oil, Ltd., Dartmouth	32,500	12,500	S-C-A	Tube & Tank
Total	32,500	12,500		

ONTARIO

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
British American Oil Co., Ltd., Toronto	6,000	3,000	S-C	Dubbs, Cross
Burlington Refineries, Ltd., Hamilton*	600	.....	S	
Canadian Oil Co., Ltd., Petrolia	3,000	2,000	S-C	Dubbs
Good Rich Ref. Co., Ltd., Port Credit	4,000	1,000	S-C	Dubbs
Imperial Oil, Ltd., Sarnia	33,000	15,600	Comp.	Tube & Tank
McColl-Frontenac Oil Co., Ltd., Toronto	12,000	7,000	S-C	Gasoline Prod.
Total	58,600	28,600		

*Shut down.

QUEBEC

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
British American Oil Co., Ltd., Montreal	12,000	7,500	S-C-A	Winkler-Koch
Champlin Oil Products, Ltd., Montreal	2,500	.....	S	
Gen. Pet. Refineries, Pointe-aux-Trembles	300	.....	S-C	
Imperial Oil, Ltd., Montreal	25,000	11,500	S-C-A	Tube & Tank
McColl-Frontenac Oil Co., Ltd., Montreal	20,000	12,000	S-C	Gasoline Prod.
Shell Oil Co. of Canada, Ltd., Montreal	7,500	5,500	S-C	Dubbs Comb.
Total	67,300	36,500		

SASKATCHEWAN

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
British American Oil Co., Ltd., Moose Jaw	4,000	2,000	S-C-A	Winkler-Koch
Consumers Co-op. Ref., Regina	1,500	600	S-C	Dubbs
Eston Ref. Co., Ltd., Eston	300	.....	S	
Hi-Way Refineries, Ltd., Moose Jaw	350	.....	S	
Hi-Way Refineries, Ltd., Regina*	350	.....	S	
Hi-Way Refineries, Ltd., Regina*	500	.....	S	
Hi-Way Refineries, Ltd., Rosetown*	350	.....	S	
Hi-Way Refineries, Ltd., Saskatoon	350	.....	S	
Hi-Way Refineries, Ltd., Swift Current*	350	.....	S	
Hi-Way Refineries, Ltd., Weyburn*	350	.....	S	
Home Oil & Ref. Co., Ltd., Humboldt	400	.....	S	
Imperial Oil, Ltd., Regina	7,500	2,300	S-C-A	Tube & Tank
Natural Sodium Products, Ltd., Bishopric*	1,000	.....	S	
Northern Pet. Corp., Ltd., Kamsack	200	.....	S	
Sterling Ref., Ltd., Yorkton	1,000	.....	S	
Total	18,500	4,900		

*Shut down.

Operating Refineries in Mexico

Company and plant location—	Crude oil cap.	Cracking cap.	Type of refinery	Type of cracking plant
Petroleos Mexicanos, Ciudad Madero	29,000	7,600	Comp.	Dubbs-Gyro
Petroleos Mexicanos, Arbol Grande	10,400	...	S-L-W	
Petroleos Mexicanos, Bella Vista	1,000	830	S-C	Dubbs
Petroleos Mexicanos, Mata Redonda	11,900	6,400	S-C	Kellogg
Petroleos Mexicanos, Poza Rica	7,500	...	S-A	
Petroleos Mexicanos, Minatitlan	24,000	4,000	Comp.	Dubbs
Petroleos Mexicanos, Mexico City	16,000	.....	S	
T. Meza Moreno, P. y. Aguacate	315	.....	S	
Refinerias Mexico, Nuevo Laredo	330	.....	S	
Refineria Laredo, Nuevo Laredo	190	.....	S	
Refineria Union, Monterrey	160	.....	S	
Refinaria del Norte, Cd. Juarez	1,000	.....	S	
Total	101,795	18,830		

A POINT WORTH ENLARGING—TO HELP YOU BUY WELDING FITTINGS WISELY!

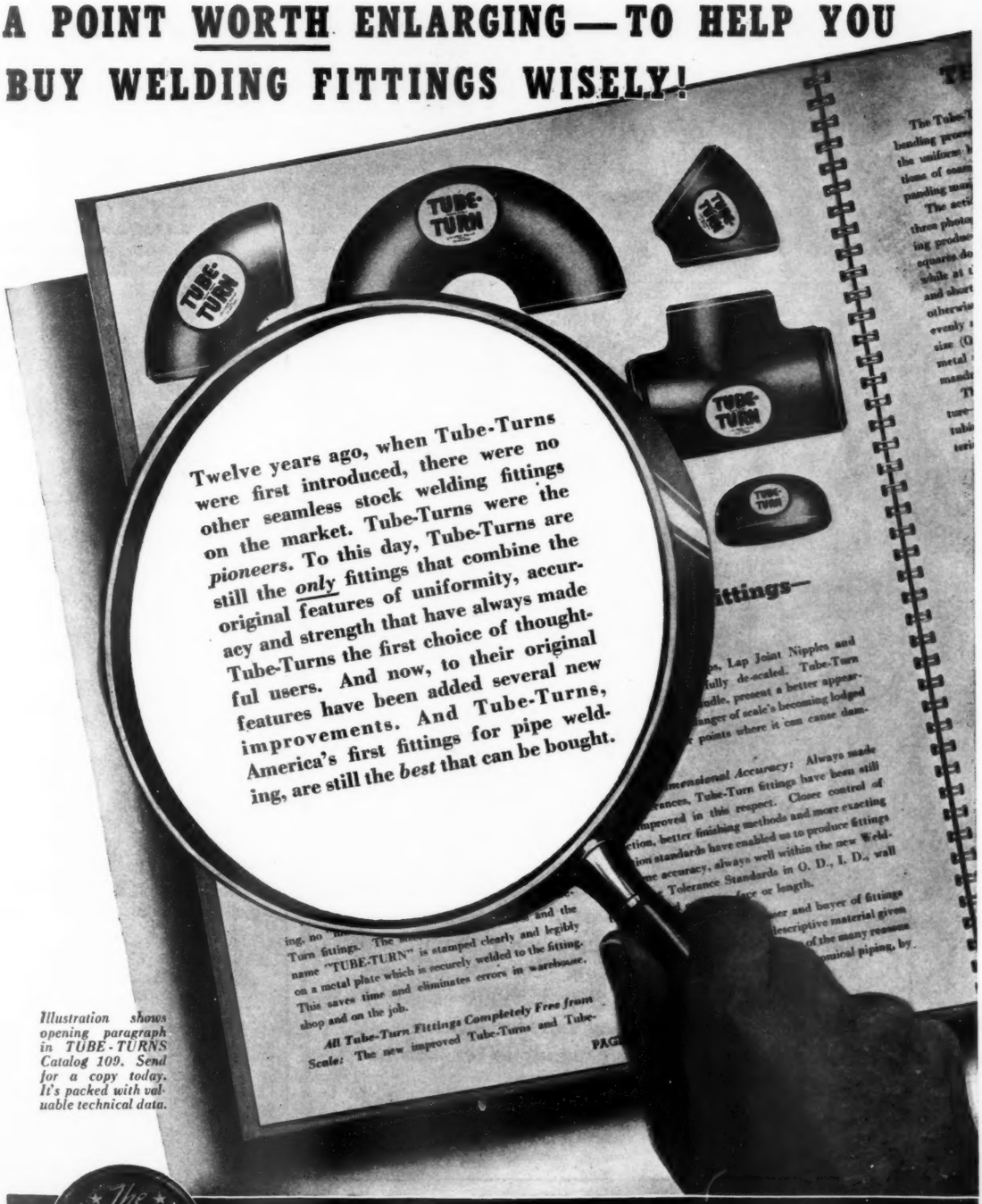

TUBE-TURN
Twelve years ago, when Tube-Turns were first introduced, there were no other seamless stock welding fittings on the market. Tube-Turns were the *pioneers*. To this day, Tube-Turns are still the *only* fittings that combine the original features of uniformity, accuracy and strength that have always made Tube-Turns the first choice of thoughtful users. And now, to their original features have been added several new improvements. And Tube-Turns, America's first fittings for pipe welding, are still the *best* that can be bought.

Illustration shows opening paragraph in TUBE-TURNS Catalog 109. Send for a copy today. It's packed with valuable technical data.

The FIRST WELDING FITTINGS 1ST AND STILL THE BEST

TUBE-TURNS

The original seamless welding fittings: 45° and 90° elbows, 180° returns, tees, reducers, heads, nipples, lateçals and flanges

TUBE-TURNS, Inc., Louisville, Ky. Branch offices: New York, Chicago, Philadelphia, Pittsburgh, Los Angeles

Well stocked distributors in every important city and area offer prompt delivery

Laboratory-Controlled Reflux Distillation Apparatus

(Continued from Page 150)

motor naphtha and gas oil.

Table 1 shows some typical data from duplicate laboratory runs on one charging stock at the standard rate of 10 ml. per minute and 5:1 reflux ratio. It is seen that the vapor and liquid temperatures and the yields of products check very closely on the two runs. The A.S.T.M. distillations on the products check within the limits of accuracy of the A.S.T.M. distillations. These two controlled-reflux distillations were made on different stills by different men under routine operating conditions.

The distillations are not necessarily stopped at the temperature of end point of the gasoline as determined by A.S.T.M. distillation. For example, it will be noted in Table 1 that stopping the distillation at 415° F. vapor temperature gave a 400° end-point gasoline. About 10° of that difference is due to the stem correction of the thermometer (a 3-in. immersion thermometer is used in the controlled reflux head while the A.S.T.M. thermometer is calibrated for total immersion) but in general the vapor-cut point required to give the desired end-point gasoline varies with both the yield of product from the charge and the type of charge. A correlation has been made of the various factors affecting the end point so it is now possible on most charges to choose the vapor-cut point that will give the desired end point.

Fig. 5 shows plots of A.S.T.M. distillation on a run where 50° F. cuts were taken up through 450° F. vapor temperature. This plot of A.S.T.M. distillation on the 50° cuts shows considerable overlapping between end points and initial boiling points of the various cuts and is therefore a more critical evaluation of the performance of the column than are the plots of distillation of the wider cuts shown in Figs. 3 and 4. Considerable variation in the shape of these curves can be obtained by varying the reflux rate or the rate of distillation so curves of this type may be used as a means of comparing fractionating efficiencies under conditions of operation.

TABLE 1—DUPLICATE RUNS ON CONTROLLED-REFLUX DISTILLATION APPARATUS

Yield—	Run 1	Run 2
Overhead, per cent volume charge	58.4	58.5
Bottoms, per cent volume charge	41.6	41.0
Loss, per cent volume charge	0.0	0.5

Controlled-reflux distillation data—5:1 reflux ratio—distillation rate 10 ml. per minute.

Per cent distilled	Temperatures Liquid, °F.	Liquid, °F.	Liquid, °F.	Vapor, °F.
5	122	60	148	72
10	170	66	186	74
20	250	130	245	126
30	342	202	332	196
40	409	278	400	262
50	476	362	468	347
Cut point	497	415	502	415

A.S.T.M. Distillation of Products

	Overhead	Bottoms	Overhead	Bottoms
Grav., °A.P.I.	66.3	32.3	66.1	32.3
Per cent evaporated				
I.B.P.	...	428	...	432
5	...	460	...	462
10		468		468
20	103	478	103	478
30	128	487	130	488
40	155	497	155	498
50	184	507	183	508
60	219	519	218	518
70	258	534	257	532
80	296	554	295	552
90	332	588	332	588
95	352	623	357	624
End point	402	690	398	684
Per cent over	99.4	99	99.2	98.5
Res., per cent	0.6	1	0.8	1.5

Because of its design, the column could be operated satisfactorily under a wide range of reflux ratios and rates of distillation but in this laboratory, there has been no need for thorough investigation of the performance at conditions other than 5:1 reflux ratio and 10 ml. of distillate per minute, since at these conditions it has been possible to obtain yields that enable us to correlate the results with commercial operation.

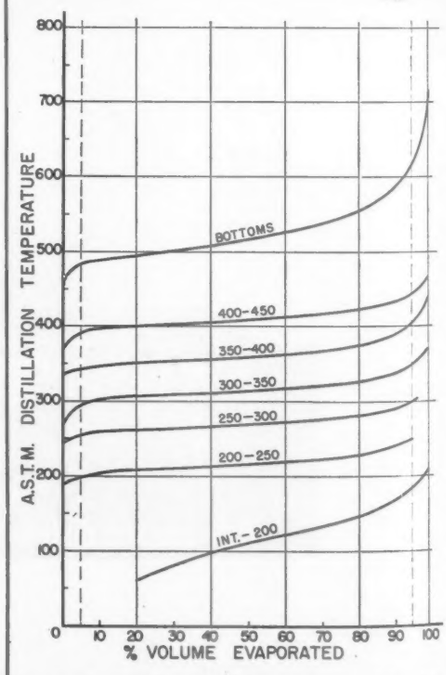


Fig. 5—Distillation with 50° vapor cuts on laboratory-controlled reflux tower

BADGER EXPANSION JOINTS

Stainless Steel . . . TO RESIST High Temperatures High Pressures Corrosion

Packless . . . . . TO ELIMINATE All Maintenance throughout their long life

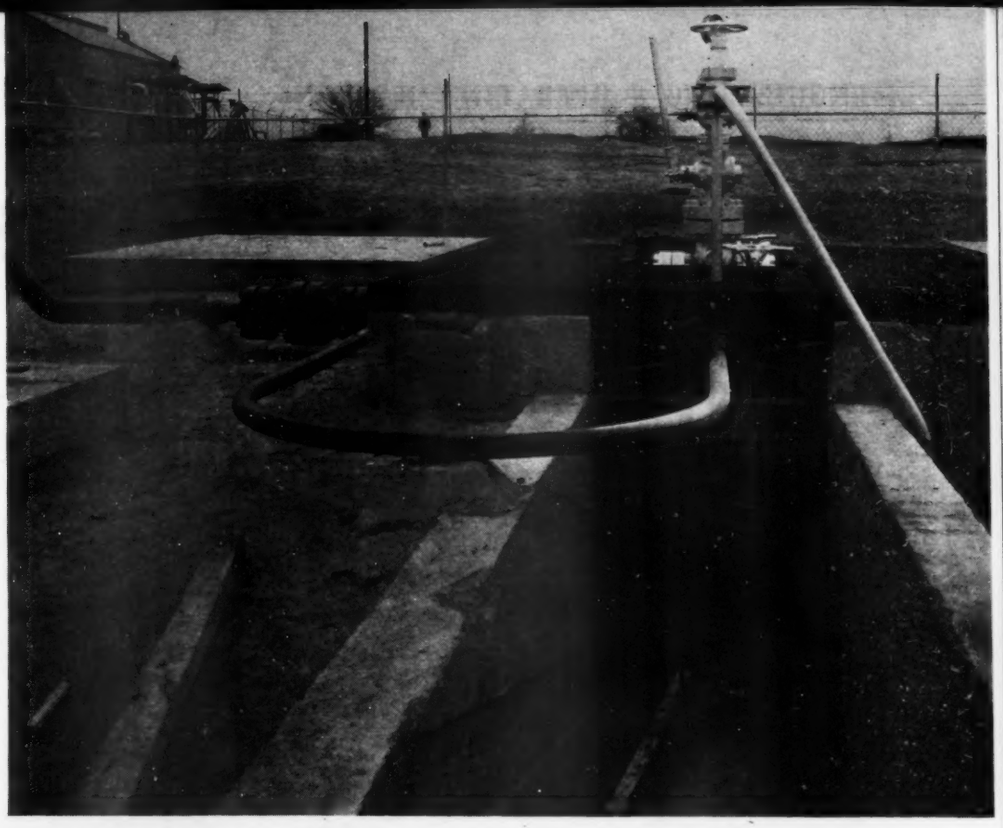
Need more be said other than that these expansion joints are designed with the life-extending Directed Flexing corrugation and Equalizing Rings . . . that they are scientifically heat-treated throughout fabrication . . . that they come in sizes ranging up to 30 inches . . . that they are built by

E. B. BADGER & SONS CO., BOSTON

E. B. BADGER & SONS CO.

75 PITTS STREET BOSTON, MASS.

Agents in Principal Cities



In gas-recycling operations the high pressures used require that well-head equipment be of extra-heavy construction and that adequate surface controls be provided. At the injection well shown here, located in the Opelika field of eastern Texas, 50 million cubic feet of gas at 3,700 lb. pressure are returned daily. To provide lateral support to the christmas tree, steel beams were placed around the sides of the cellar with steel arms radiating from a collar placed midway up the well-head assembly

ENGINEERING & OPERATION

In This Section

MARCH 27, 1941

PORTABLE SPUDDERS USED FOR DEEPENING WELLS AT SALEM

By Harry F. Simons ..... Page 198

In the development of Illinois' new oil production spudding machines have been used mainly for completing wells after rotaries had drilled to the top of the pay. These machines were of limited depth capacity so that for the recent deepening campaign to the Devonian lime in the Salem pool, machines employed had to have good hole-making capacity as well as being portable. Factors making the machines feasible for drilling the 1,300-ft. interval are discussed, and various type equipment is described.

EXPERIMENTAL INVESTIGATION OF GAS-WELL GAGING IN MONROE FIELD

By D. J. Grady, Jr., and A. L. Vitter, Jr. ..... Page 200

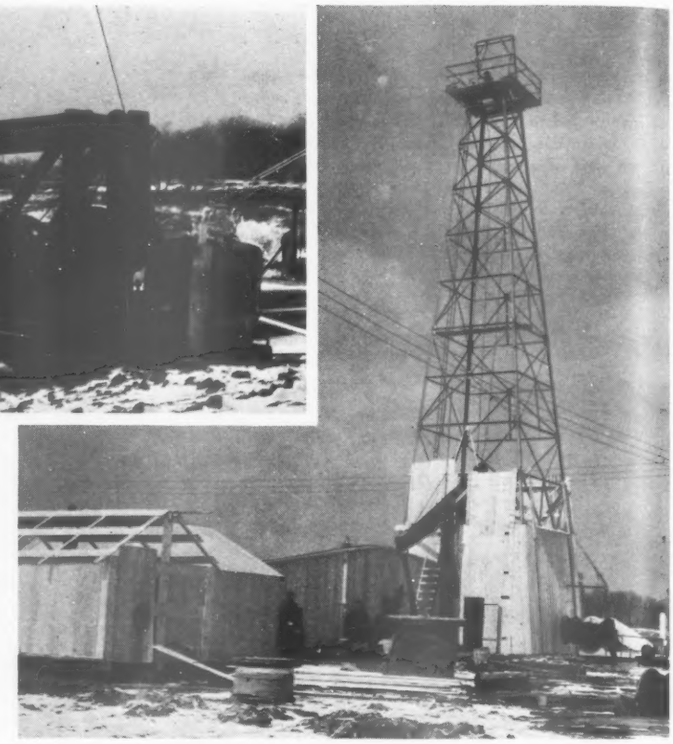
In the Monroe gas field of Louisiana the Oliphant formula has been used since the field's discovery for interpreting pitot-tube measurements. Following issuance of an order permitting acidizing, which resulted in substantial increases in open-flow capacities, it was quite evident that continued use of the formula would introduce errors as much as 30 per cent in the larger well gages. Therefore a new productivity test was inaugurated that has proven to give reliable gages with a minimum of time required for making the test. The productivity test is merely a simplified back-pressure test, with many of its advantages but partially eliminating practical disadvantages encountered in the Monroe field.

QUESTIONS ON TECHNOLOGY—By W. L. Nelson ..... Page 208

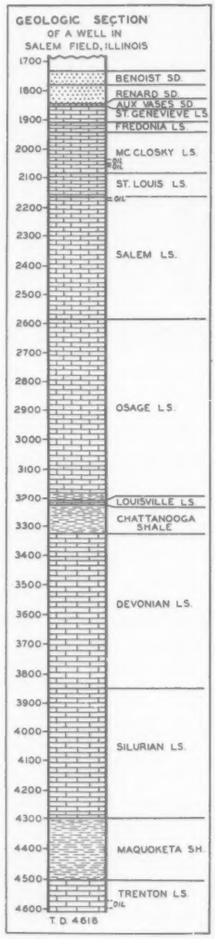
Relations between viscosity measurements taken on various instruments, identification of additives in lubricating oils, conversion of Stormer viscosity units into Furol units and cost of treating various light oils are discussed.

Portable Spudders Used for Deepening Wells at Salem

Horizontal beam-type spudder deepening a well in the Salem field from the Devonian to the Trenton lime. The pumping unit is left in place with the mulehead removed



Above: Standard rig including belt shed, engine shed and forge house preparing to start deepening a well to the Trenton in the Salem field. This type rig is a recent importation into the basin. Left: Typical geological section encountered by wells drilling in the Salem field



By HARRY F. SIMONS

FOR most of the past 3 years, spudding machines in Illinois have been mainly used for completion of wells after the pipe had been set on top of the pay with a rotary drilling rig. Some of the fields in the state were drilled and completed by the rotary method but for the most part the plan has been to drill with the rotary and complete with cable tools. The type machine used for the completion work had a limited depth capacity and was generally not suited for making a great amount of hole; portability was one of the outstanding features.

A different type of machine became needed in the Salem pool with the campaign of deepening holes from the Benoist and Aux Vases sands and McClosky lime to the St. Louis-Salem pay zone. The interval from the Benoist to the Salem pay is approximately 440 ft. and the machines employed had to have a good hole-making capacity as well as being portable. Large spudders, some capable of drilling to as much as 7,000 ft., were put to work on this program.

A bigger job has been presented to these machines in the past few months, the deepening to the Trenton lime of wells drilled to the Devonian lime. The section between the two pays is approximately 1,300 ft. and the depth to the Trenton pay is around 4,600 ft. The depth to which the wells must be deepened narrows the available machinery to the most modern of the spudders and rig fronts and to those having a depth capacity of at least 5,000 ft.

Experience so far in the state has shown that in any extensive deepening program, particularly below the Devonian, and often below the McClosky lime, the spudding machines can compete with the rotary rigs and in some cases have a definite cost advantage. The recent failure of the St. Peter to produce in the Salem field throws a wet blanket on the state's deep production possibilities. However, in drilling to the Trenton lime, the state's deepest producing horizon, a combination method of drilling may be a possibility and for deepening of wells in the lower section, the spudding machines have an edge.

The spudding machines have three advantages, small moving expense, very little rigging-up time and low operating costs. The rotaries take from 18 to 24 hours to rig up on a deepening job, the cost of moving drill pipe and machinery is an important item and the labor and bit costs send the total bill upward. The price per foot which must be obtained to show only a small profit for a rotary deepening job is sufficient to show a very nice profit on the spudding-machine method of deepening.

The section above the McClosky lime is well suited to rotary drilling but below that point the formations are hard enough to cause a sharp decrease in the rate of penetration. When drilling a well from the surface, the rotary method has an advantage as its high rate of penetration in the upper formations offsets the slow rate of penetration and the loss of circulation in the lower horizons. Where a well is to be deepened, the rotary operator is deprived of the income from softer formations to balance the high cost of drilling in the lower zones.

The cable-tool method is a slow and costly one when employed in the upper formations. The hole refuses to stand up and frequent water-bearing zones give great difficulty and cause the running of several strings of pipe. Below the McClosky lime, the picture changes as the formations are mostly lime, the hole stands up well and the water is not troublesome.

Another factor affecting the choice of method of deepening wells is the size of the pipe run to the Devonian or McClosky pays. Some wells are equipped with 8-in., some with 7-in., some with 5½-in. and some with 4½-in. casing. There are other sizes in between which have been used in some wells. Holes equipped with extremely small sizes of pipe are not suitable for deepening by any method as the casing would need to be extremely small.

The deepening of the wells equipped with 4½-

in. casing would be extremely hazardous as the smallest drill pipe commonly used (3½ in.) does not permit sufficient clearance for efficient operation. Smaller sizes of pipe could be obtained but their cost for a limited amount of work would be excessive. Holes equipped with larger casing present no obstacle to rotary drilling from this viewpoint.

Deep Rotary Tests

Some idea of the costs of rotary drilling in the deeper formations can be gained from the bit record of the Stella Billington well drilled to the St. Peter in the Cisne field by the Pure Oil Co. This test used 175 bits of the 8⅝-in. size from a depth of 3,225 ft. to 7,207 ft. It took almost 5 months to drill the hole.

The deep test to the St. Peter sand in the Salem field used 26 bits from the Devonian to the Trenton lime and approximately the same number below that formation to the St. Peter. Trouble was experienced with the Maquoketa shale and the pump pressure was unusually high due to the small clearance in the 6¼-in. hole. Some bits made as little as 1 ft.

Deep Cable-Tool Test

The deepest cable-tool test drilled in Illinois in recent years was also the first to penetrate the Trenton lime in the western side of the basin. It was the Martin 1 Robinson in SW SE SW 4-2n-1e, in the Sandoval field of Marion County. The well was originally drilled to 3,004 ft. in the Devonian lime, where it was produced for some time. As the Devonian production declined, it was decided to deepen the hole. A rotary was used to drill the hole to 4,312 ft. and 4-in. casing was run to 4,220 ft.

A double-drum oscillating-type spudding unit, belonging to Big Chief Drilling Co., was moved in and rigged up under the derrick. This spudder will spool 10,000 ft. of ⅝-in. drilling line.

After drilling the plug, running electrical log, acidizing, swabbing, shooting, reacidizing, the hole was drilled to a total depth of 4,394 ft. and temporarily abandoned and the spudding machine moved off. Two weeks later the spudding machine was again rigged up and deepening resumed. A total of 45 days was required to drill the hole from 4,394 to 5,023 ft. in the St. Peter sand.

For drilling inside the 4-in. pipe, a 3⅛-in. bit was used on a 3-in. stem with short jars. Sulfur water was encountered at 4,390 ft. and as the hole was deepened the water kept rising until at 4,520 ft. the hole was almost full of water. The hole was also tight in numerous spots and about 2 hours was the most a bit could be run with safety. The formation was almost continuously lime with the exception of a few shale breaks.

The tools were run with the maximum stroke of 42 in., but due to the water in the hole a slow motion was used. During the average day from 18 to 20 ft. of hole was made although exceptionally hard streaks would slow down progress to 1 or 2 ft. per tour. There were no fishing jobs although the hole was extremely hard on wire lines and additional line had to be spliced on before the hole was completed.

Salem Field

For deepening the wells in the Salem field, both the horizontal-beam type and the oscillating-type spudders have been used; several portable standard rig fronts also have been at work in the field. In recent months there have been some regular standard rigs brought into the pool. The time required to deepen the wells depends to a great extent on the efficiency of the spudder used. Spudders which are easily controlled, which have a good motion and can hoist and lower the tools and bailer rapidly, have an advantage. The better spudders are also very easy on a drilling line and can also make hole faster as they have a better motion.

The modern spudders used at Salem have a distinct advantage when it comes to handling tubing, casing and liners. Because they have multiple-speed drums they resemble a rotary hoist and in most cases can run casing in approximately the same time. A saving of 5 hours is made with the better spudding machines over those not so well designed for the running of casing and tubular equipment.

With a good machine and a good crew, it is possible to complete a deepening job in less than 28 days. This was done on one of the early wells in the field with 50 hours of that time being lost due to a fishing job and a fire. The spudder used was of the oscillating type. As the drilling crews become more familiar with the formations and conditions encountered, this time will be reduced.

Some of the Devonian wells which are being deepened to the Trenton have 5-in. casing and others have 7-in. casing or larger. Drilling below the 5-in. pipe is done with a 4 7/16-in. bit with a ¾-in. line; 4-in. liners are run in this type of hole. Below the 7-in. pipe a 6¾-in. hole is made and a ⅞-in. line is used for this purpose; 5-in. liners are run in these holes. Bits used are either dressed at the rig or are machine-dressed.

Type Equipment Used

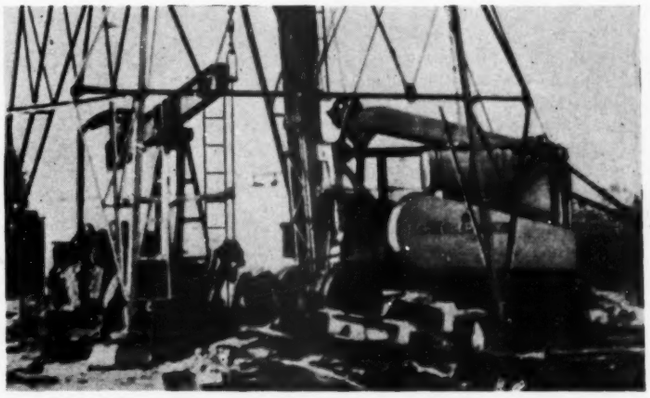
One line is used for each deepening job, the length most generally purchased for the work at Salem being 6,000 ft. Lines used are mostly right lay and either 6-by-19 or 6-by-21 construction. A swivel socket is used by most of the drilling organizations with the line being either babbitted or dry-filled in the socket. One drilling organization uses left-lay lines with a stiff socket and a cracker.

Stems used in Salem are 3½ in. in diameter and around 30 ft. in length. Some few are longer when new, but most in use are shorter due to their having been cut off occasionally. Regular short-stroke jars are used, but a 4-ft. sinker bar is run on top of them. This permits driving through sticky places and allows jarring in case the tools become stuck. Properly designed spudding machines can drive through a sticky place much faster than regular cable-tool rigs as they do not have to stop to slip the clamps or pull over more line.

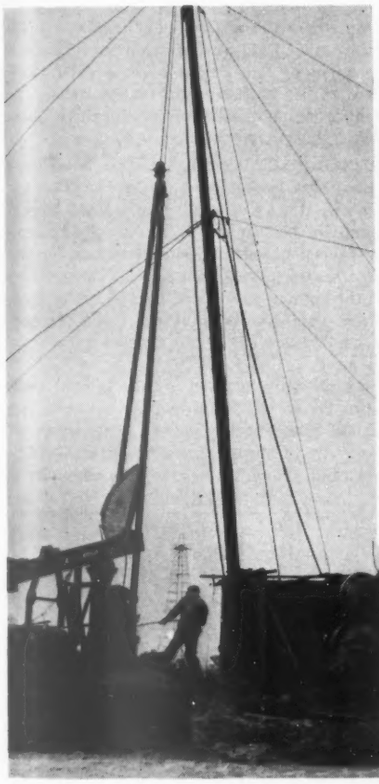
The formations below the Devonian are predominantly lime and the drilling of this section

(Continued on Page 206)

Right: Horizontal-beam type spudding machine on a deepening job in the Salem field



Left, below: Double-drum spudder with telescopic mast used for workover jobs. This size rig was suitable for the St. Louis-Salem deepening program. Below: Heavy double-drum oscillating-type spudder at work completing a Trenton well. Tools can be pulled from the hole and bailer run in minimum time



Experimental Investigation Of Gas-Well Gaging

A statement of conditions and difficulties encountered in obtaining reliable gages in the Monroe gas field of Louisiana . . .

By D. J. GRADY, JR., and A. L. VITTER, JR.
State of Louisiana, Department of Minerals

COMMERCIAL production from the Monroe gas field, located in Ouachita, Morehouse, and Union parishes of Northeast Louisiana, was first obtained in 1916 from the Progressive Oil & Gas Co. 1 Fisher, located in Section 37, Township 20n, Range 5e. Since discovery the field has been extensively developed. The production history is graphicaHy represented in Fig. 1. The field now extends over an area of approximately 430 sq. miles and has produced 2,809 billion cubic feet of metered gas. The geology and early development has been discussed by Fergus[1] and Bell.[2]

According to Act 252 of the Louisiana Legislature of 1924, gas production is allocated on a basis of open-flow capacity of the well and the acreage allotted to the well, as illustrated in Table 1.

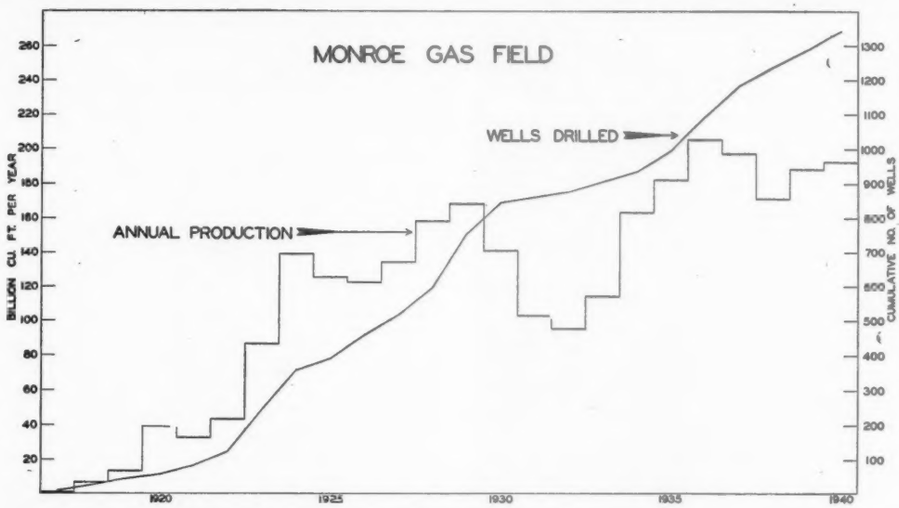


Fig. 1, above—Production history and drilling activity in the Monroe field. Fig. 2, right—Correction factors applied as a percentage addition for various-size wells when blown through 4 and 6-in. nipples

Wells spudded in before June 24, 1924, were allowed 20 per cent of their open-flow capacity regardless of acreage, and direct offsets to such wells are allowed the same. For the purpose of allocation of production the same act provides for the determination of the open-flow capacity of each producing well every 12 months and of the closed pressure of each producing well once every 4 months. The closed pressure is to be used in modifying the last determined open-flow capacity in direct proportion to the decrease or increase of closed pressure since the previous gage. This corrected open-flow capacity is to be used for the current allocation of production.

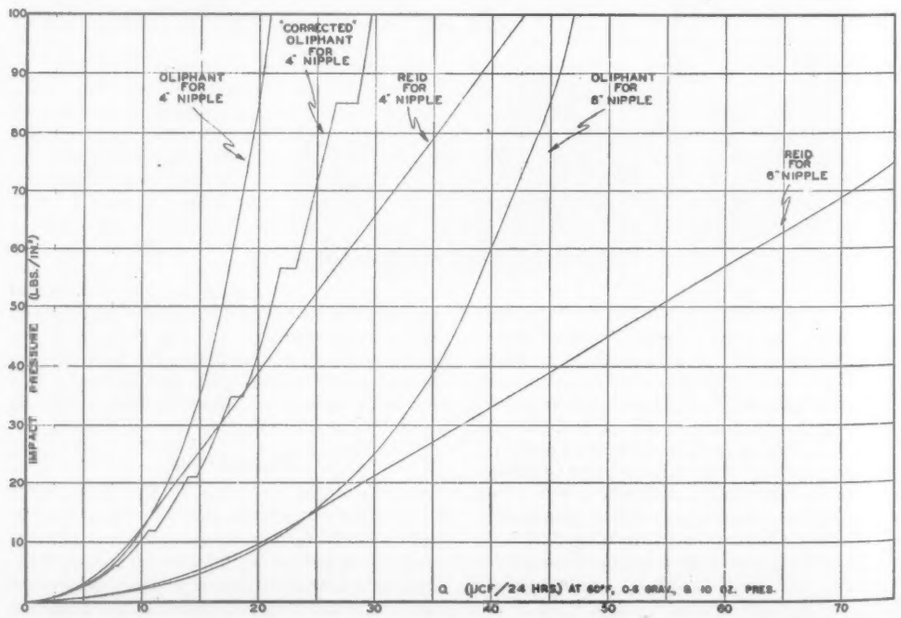
Open-flow capacities in the field have been determined to date by blowing the wells to the atmosphere and measuring the rate of flow by means of pitot-tube observations. The impact pressures obtained in these tests were interpreted by means of the Oliphant[3] formula, which was accepted as the best existing prior to 1929. However, in the latter part of 1929, Reid[4] published the results of some experimental tests of open-flow determinations of gas wells and these were soon accepted by the gas industry, replacing Oliphant's formula. Reid's work was later checked by the Bureau of Mines[5] and became even more established in the industry and recognized as the first really reliable means of interpreting pitot-tube measurements.

Although Reid's interpretation had been used by the Louisiana Department of Conservation for several years, it was officially recognized by the department in 1937 when it published natural-gas flow tables[6] based on Reid's formula for impact pressures up to 14 lb. per sq. in. These tables are used throughout Louisiana, except in the Monroe district, principally for gas measurements from oil wells, gas wells being gaged by the back-pressure method.

The back-pressure method was never adopted, nor the change to the Reid formula made, in the Monroe field, possibly because the regage records since discovery of the field are based on the Oliphant formula. However, prior to Order 19 of

TABLE 1—PRODUCTION SCHEDULE APPLYING TO GAS WELLS IN LOUISIANA, THE DRILLING OF WHICH WAS BEGUN AFTER JUNE 24, 1924

Acreage allotted	Per cent open-flow capacity
160	24
80	21
40	18
20	15
10	12
5	9
Below 5	7


"CORRECTED" OLIPHANT FOR 4" NIPPLE
OLIPHANT FOR 4" NIPPLE
REID FOR 4" NIPPLE
OLIPHANT FOR 8" NIPPLE
REID FOR 8" NIPPLE
IMPACT PRESSURE (LBS./IN.²)
Q (MCF/24 HRS) AT 60°F, 0.6 GRAV., & 10 OZ. PRES.

1 When old rubbers are worn, don't throw away the piston, remove the old rubbers and save the piston.

2 It's not even necessary to remove the piston body from the rod. You save on shut down time when rubbers are changed.

3 New rubbers are installed and the piston is ready for another long run at a fraction of the cost of a new piston.

Mission Replaceable Piston Rubbers mean low piston replacement costs. You don't have to pay for a complete new piston every time rubbers wear out. You simply install new rubbers on the old piston body and you are ready for another long run.

You get a double saving with Mission Pistons. In addition to saving the cost of a new piston body when rubbers are changed, you save because these tough rubbers stay in your pump longer without trouble.

Guarantee: Thousands of operators all over the world have proved beyond doubt that Mission Pistons reduce pump upkeep costs. This record of superiority is so consistent that we guarantee the Mission Piston to be the most economical on the market to operate.

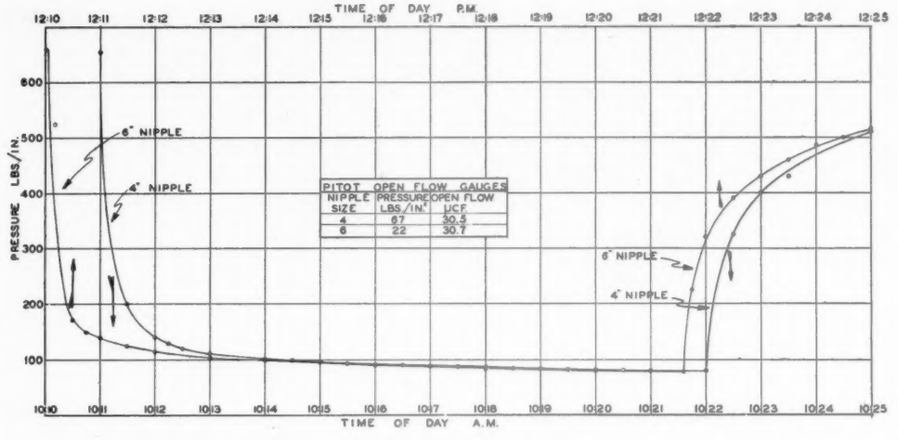
Complete information, including prices, on Mission Pistons are found in your 1941 Composite Catalog. These pistons, along with other Mission Products, are at your favorite Supply Store. Mission Manufacturing Company, Houston, Texas. Export Office: 30 Rockefeller Plaza, New York.

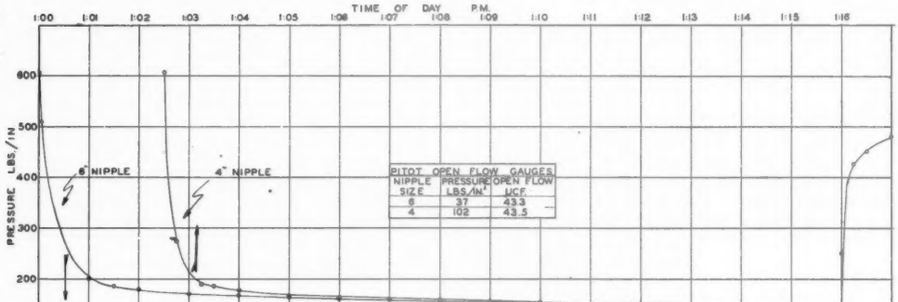
MISSION

SLUSH PUMP PARTS

Your pumps stay running longer and cost less to repair when equipped with Mission Pump Parts

More Mission Slush Pump Pistons Are In Use Than Any Other Make


TIME OF DAY P.M.
6" NIPPLE
4" NIPPLE
PITOT OPEN FLOW GAUGES
NIPPLE SIZE | PRESSURE LBS./IN² | OPEN FLOW MCF.
4 | 67 | 30.5
6 | 22 | 30.7
PRESSURE LBS./IN.
TIME OF DAY A.M.


TIME OF DAY P.M.
6" NIPPLE
4" NIPPLE
PITOT OPEN FLOW GAUGES
NIPPLE SIZE | PRESSURE LBS./IN² | OPEN FLOW MCF.
6 | 37 | 43.3
4 | 102 | 43.5
PRESSURE LBS./IN.
TIME OF DAY A.M.

Figs. 3A, 3B, above—Pitot-tube measurements made on several wells open-flowed through 4 and 6-in. nipples

the Louisiana Department of Conservation, which was issued in August 1940 and allowed acidizing in the Monroe field, the wells had become relatively small, few of them reaching the point of critical flow when blown to the atmosphere through 6-in. pipe, above which point Oliphant's formula is seriously in error. Fig. 2 shows a comparison of the Oliphant and Reid formulas for 4 and 6-in. nipples, each nipple being the recommended minimum length of eight diameters.

When Order 19 went into effect and substantial increases in open-flow capacity were obtained it was quite evident that the continued use of the Oliphant formula would introduce errors as much as 30 per cent in the larger wells. As far back as 1925 a discrepancy was noted when wells were blown through 4 and 6-in. nipples and a "correction factor"[7] was developed to be applied as a percentage addition for various-size wells when blown through 4-in. fittings on 6-in. casing. These

TABLE 2—ALLOWED "CORRECTIONS" WHEN GAGING THROUGH 4-IN. NIPPLE AND INTERPRETING BY OLIPHANT'S FORMULA

Size of well (μ c.f.*/day)	Add (%)
0.0- 5.0	0
5.0- 7.5	3
7.5-10.0	7
10.0-12.5	12
12.5-15.0	18
15.0-17.5	25
17.5-20.0	33
20 plus	42

*Million cu. ft.

"correction factors" are shown in Table 2 and are illustrated graphically in Fig. 2.

At the time of its conception it was not regarded as a correction to the formula but merely an "allowance" that should be made in gaging through 4-in. nipples, because it was supposed that the swedge from the 6-in. casing to the 4-in. nipple held a back pressure on the well, thereby not allowing it to blow as much gas. Actually the swedge and 4-in. nipple cannot account for a back pressure sufficient to appreciably change the open-flow capacity of a well the size of those in the Monroe field.

The only conclusion is that the discrepancy is inherent in the Oliphant formula above critical flow. However, to substantiate this, tests were made in which several wells were open-flowed through 6 and 4-in. nipples and typical results are shown in Figs. 3A and 3B. In each of these figures it can be seen that the back pressure on the casing was practically identical for both 4 and 6-in. nipples. Furthermore, the pitot-tube measurements, when interpreted on Reid's formula, show an exact check within the experimental accuracy of the tests. The results of these tests are repeated here in Table 3 for comparison with the results obtained when computed on the Oliphant formula. Reid's formula below and above critical flow (approximately 15-lb. per sq. in. impact pressure) for water and mercury manometer and spring-gage readings is shown in Table 4.

TABLE 3—COMPARISON OF REID AND OLIPHANT FORMULAS IN ACTUAL PITOT-TUBE TESTS

	Pitot-tube impact pressure (lb./sq.in.)	Reid formula (μc.f./day)	Oliphant formula (μc.f./day)	"Corrected" Oliphant formula (μc.f./day)
Well A:				
4-in. nipple	67	30.5	18.4	24.5
6-in. nipple	22	30.7	28.7	28.7
Well B:				
4-in. nipple	102	43.5	21.0	29.7
6-in. nipple	37	43.3	34.5	34.5

Fig. 4, below—Pitot-tube open-flow test on a small gas well, which after blowing for 1½ hours was still steadily dropping in rate of production

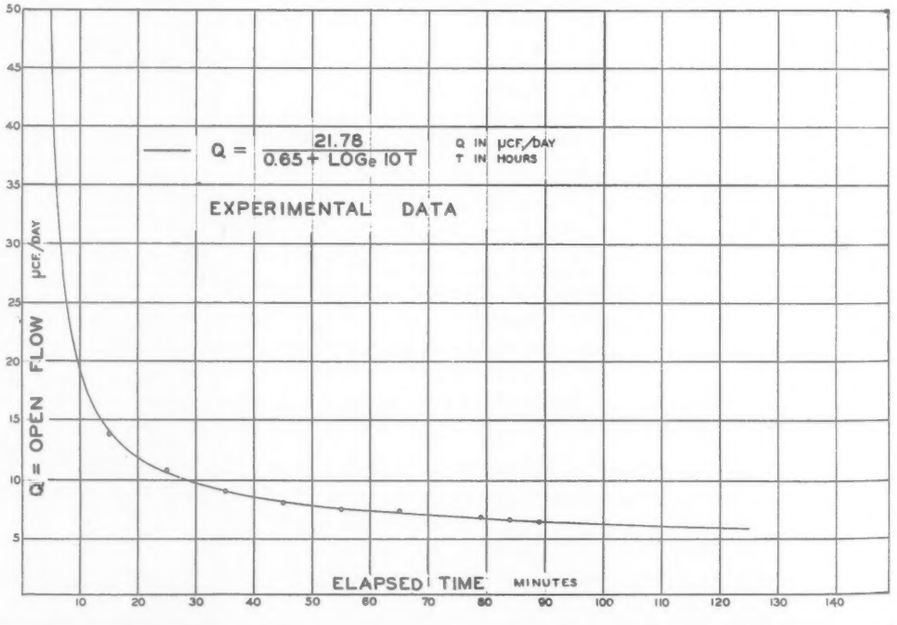
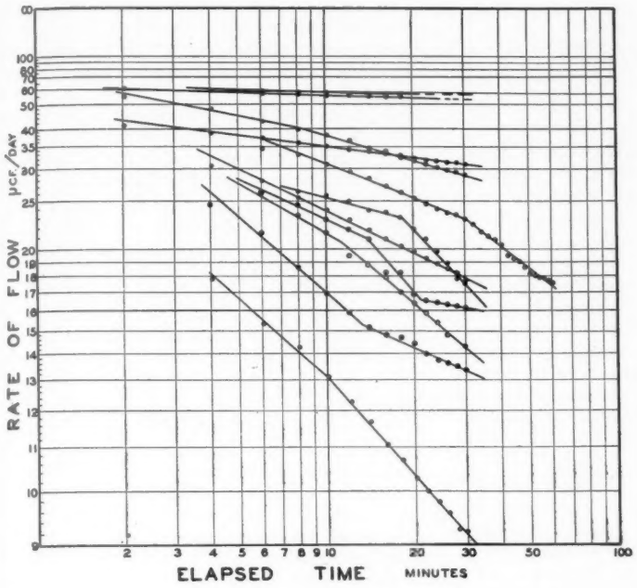
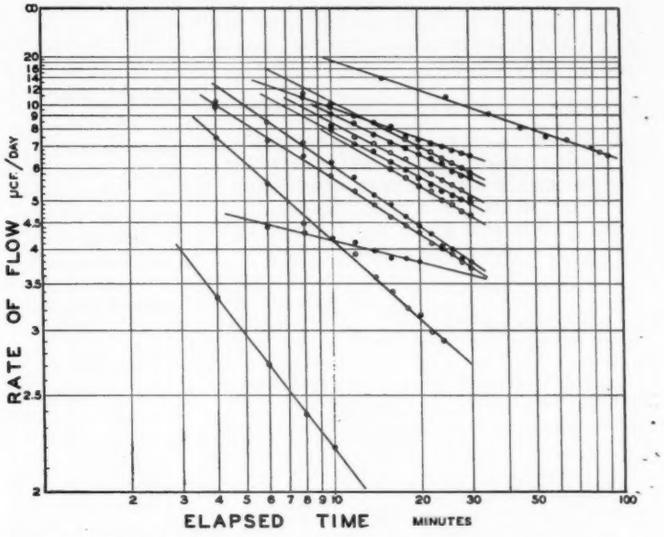


TABLE 4—REID'S FORMULA FOR 15.025 LB. PER SQ. IN., 0.6 (A = 1) GRAVITY, AND 60° F.

Range	General formula	4-in. nipple	6-in. nipple
Below 415.2 in. water	$Q = 0.03395d^2\sqrt{W}$	$= 0.5433\sqrt{W}$	$= 1.222\sqrt{W}$
Below 30.54 in. mercury	$Q = 0.1252d^2\sqrt{M}$	$= 2.003\sqrt{M}$	$= 4.507\sqrt{M}$
Above 30.54 in. mercury	$Q = 0.01144d^2(M+29.92)$	$= 0.1831(M+29.92)$	$= 0.4120(M+29.92)$
Below 15 lb. per sq. in.	$Q = 0.1786d^2\sqrt{P}$	$= 2.858\sqrt{P}$	$= 6.431\sqrt{P}$
Above 15 lb. per sq. in.	$Q = 0.02330d^2(P+14.7)$	$= 0.3727(P+14.7)$	$= 0.8386(P+14.7)$

Q, rate of flow, is expressed in μc.f. per day. *W*, impact pressure, is expressed in inches of water, gage; *M*, impact pressure, is expressed in inches of mercury, gage; and *P*, impact pressure, is expressed in lb. per sq. in. gage. All impact pressures measured at center of pipe.





Figs. 5A, 5B—Representative group of open-flow tests on wells ranging from 2 million to 60 million cubic feet per day

Pitot-tube measurements can be misleading if stabilization of the well is not certain before the impact-pressure observation is made. Therefore, the time necessary for stabilization must be ascertained to assure reliable open-flow-capacity determinations. Preliminary tests seemed to indicate that in the case of the larger wells the well is almost stabilized within 15 minutes, although a small decline thereafter is realized. On the other hand, Fig. 4 shows a pitot-tube open-flow test on a smaller well which was blowing for 1½ hours and still steadily dropping in rate of production.

An attempt was made to establish from fundamental theory what might be the time expected as the time of stabilization. Starting from the equation of state of a gas, Darcy's law of viscous flow of fluids through porous media, and the equation of continuity,* one obtains as the differential equation governing the flow of gas through porous media,

$$\Delta^2\gamma^{(1+m)/m} = \frac{(1+m)\mu f\gamma_0^{1/m}}{k}\frac{\partial\gamma}{\partial t}$$

Unfortunately, the above differential equation is analytically unsolvable, and approximate solutions must be resorted to. The method of attack is this: The well is assumed to be in a steady state at any one time within the effective drainage area at that time; the drainage area increases with time however, and it is thus that the study of the stabilization curve is allowed.* The drainage area in the sense used here, means the area around the well bore which is being drained, or the area in which the pressure is reduced due to the flow of gas to the well. The approximate solution just described is good except where the time, t, approaches zero.

In order to test the soundness of these theoretical considerations, a well was open-flowed for a period of 1½ hours. The experimental data are plotted in Fig. 4, and a theoretical curve fitted to the points. It is emphasized that the curve was not expressly drawn through the points, but is a theoretical curve fitted to them. From this test some interesting deductions are allowed. Table 5 shows the theoretical formula and the results of its application.

The deductions show the time required for stabilization and the predicted open flow at that time under certain assumed conditions. There are, in the theoretical formula, four factors which are unknown, namely:

1. H, effective thickness of producing section.
2. k, permeability of producing section.
3. R_w, well-bore radius.
4. R_e, effective drainage radius.

The assumption of any one of the first three necessarily determines the remaining two, and the fourth is assumed independently. Therefore, there are only two independent assumptions made and both can be estimated within reasonable limits.

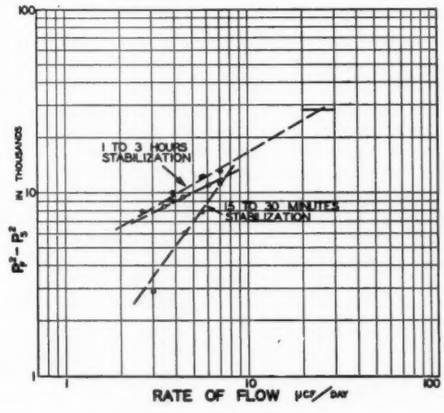
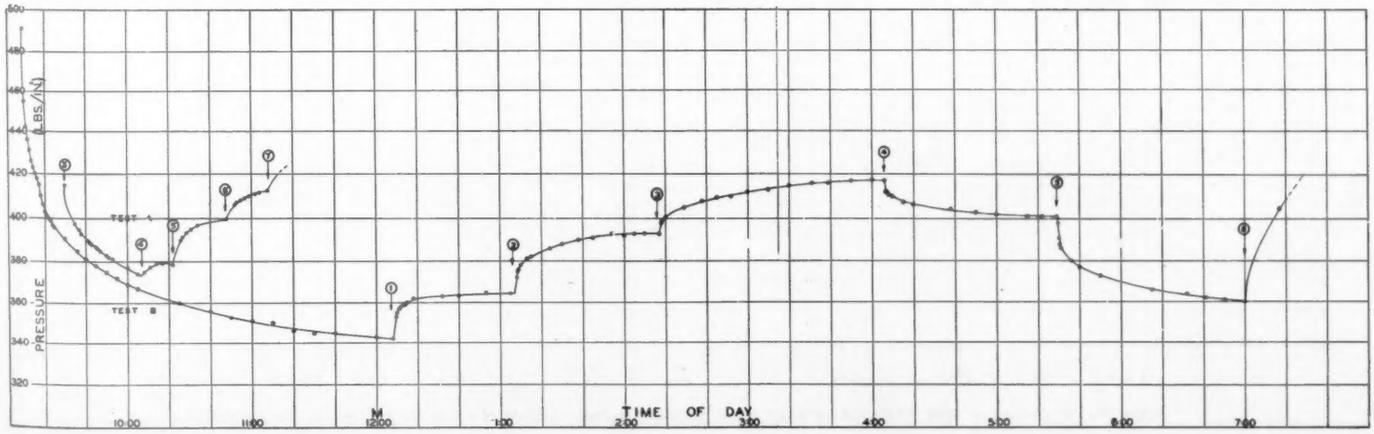


Fig. 6A, left—Typical example of a bad back-pressure test under different periods of stabilization. Fig. 6B, below—Stabilization curves of the well-head pressure in each of the tests plotted in Fig. 6A



*These three laws are statements of familiar physical laws. The equation of state of a gas is taken as $\gamma=\gamma_0 p^m$ and simply states that the gas density, γ, is dependent on the pressure, p, the exponent m varying with the thermodynamic mode of expansion or contraction; $m=1$ for an isothermal process and $m=c_v/c_p$ for adiabatic process, etc. Darcy's law, $\mathbf{v}=(k/\mu)\Delta p$, simply formulates that the macroscopic velocity, $\mathbf{v}$, is proportional to the pressure gradient, Δp, the permeability of the medium, k, and inversely as the viscosity of the fluid, μ. The equation of continuity

$$\text{div.}\,(\gamma\mathbf{v}) = \frac{\partial(\gamma v_x)}{\partial x}+\frac{\partial(\gamma v_y)}{\partial y}+\frac{\partial(\gamma v_z)}{\partial z}=-f\frac{\partial\gamma}{\partial t}$$

simply states that in any given unit space the gas density changes with time in direct proportion to the excess of gas entering that unit space over that gas which is leaving it.

It is not the intention to accord too much weight to the numerical theoretical deductions, but they do give indications of unreasonably long time periods for stabilization.

TABLE 5—THEORETICAL RELATIONSHIPS FOR THE STABILIZATION OF A GAS WELL, SHOWING DEDUCTIONS WHICH MAY BE ARRIVED AT BY APPLYING TO A PITOT-TUBE TEST. (DOES NOT APPLY WHEN TIME APPROACHES ZERO)

$$Q = \frac{2.704kHP_e^2}{\mu\left(\log_e\frac{0.10544kP_e}{R_w^2\mu f} + \log_e 10t\right)}, \qquad t_s = \frac{R_e^2\mu f}{1.0544kP_e}$$

Alternate assumptions				Deductions	
H	k	R_w	R_e	t_s	Q_s
100	0.0012075	4.978	500	526.72	2.65×10^6
			100	21.07	3.61×10^5
20	0.0060375	11.131	500	105.37	4.21×10^6
			100	4.215	4.96×10^5

Q = cubic feet per day
k = permeability, darcys
P_e = reservoir pressure, pounds per square inch
μ = viscosity, centipoises
R_w = effective well-bore radius, feet
f = porosity, fraction
t = time, hours
t_s = time required to stabilize, hours
R_e = effective drainage radius of well, feet
Q_s = stabilized open flow, cubic feet per day
H = reservoir thickness, feet

Observations were made on 500 wells during open-flow tests for this study of stabilization. In order to analyze effectively the data, they were plotted on a special scale graph, as explained below, which was designed to give a straight line if the data follow the theory, the line to become horizontal when the well stabilizes. A representative group of such tests on wells ranging from 2 μ cu. ft. per day* to 60 μ cu. ft. per day open flow are shown in Figs. 5A and 5B. It is evident in these figures that the wells are not stabilized except in the case of the very large wells. In regard to the special scale referred to above, it is pointed out that the theoretical formula given in Table 5 is of the form,

$$Q = \frac{A}{B + \log T}$$

Where:

Q = rate of flow
T = elapsed time
A = a constant
B = a constant

*μ cu. ft., million cubic feet.

If in this equation,

$$\frac{1}{Q} = y \text{ and } \log T = x; \quad \frac{B}{A} = b \text{ and } \frac{1}{A} = m$$

then the equation becomes,

$$y = mx + b$$

which is the equation of a straight line. Therefore, if $1/Q$ is plotted against log T, the theoretical formula becomes a straight line. The scales of the graph in Figs. 5A and 5B are so arranged; the rate-of-flow scale is an inverse scale and the elapsed-time scale logarithmic.

The resulting gages of the wells obtained from open flowing them to the atmosphere, for a reasonable length of time, show unreliable figures for actual capacity of the wells to produce gas. Longer periods of blowing are deemed unwise because of waste and physical harm to well equipment and the reservoir in general. It will be shown later that gages obtained in blowing to the atmosphere for 30 minutes exaggerate the ability of the wells to produce gas by as much as 200 to 300 per cent in some instances.

In order to obtain a reliable gage of the ability of the wells to produce gas and to eliminate the practice of blowing wells to the atmosphere, with its inherent undesirable features, an investigation of the practicability of the back-pressure method of gaging in the Monroe field was made. Difficulties encountered due to characteristics of the field, along with the great number of wells in the field, apparently discouraged the adoption of the back-pressure method of gaging before this time.

Upon investigating it was found that one of the major operators had been conducting such tests on their own wells for about 6 years. These tests, as they were being run, were not satisfactory but were more reliably indicative of the ability of the wells to produce than gages made by blowing the wells to the atmosphere. After careful consideration of the procedure and results of the above-mentioned tests, several wells were regaged in an effort to determine the cause of the unsatisfactory tests.

It was found that the wells were reaching a pseudostabilized condition on short-time pulls and the working pressures and producing rates under these conditions were being observed for plotting the tests. Fig. 6A is a typical example of a bad back-pressure test under different periods of stabilization. In order to study the degree of stabilization a continuous record was kept of the wellhead pressure in each of the tests on the same well plotted in Fig. 6A. These stabilization curves are shown in Fig. 6B.

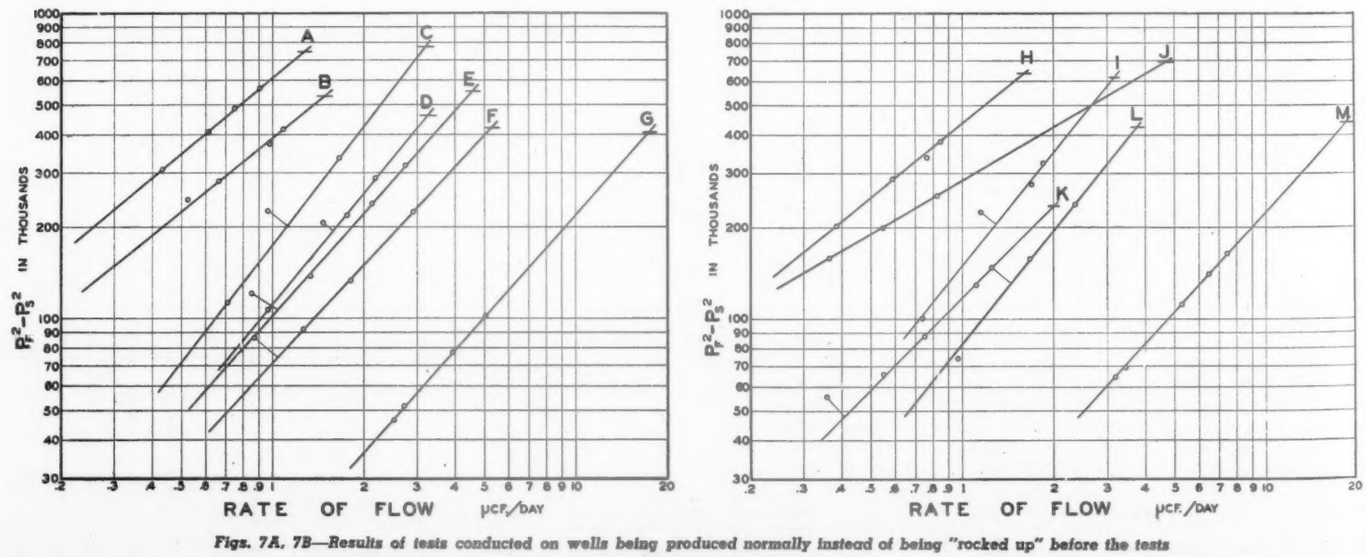
The wells used in the tests discussed in the above paragraph were all "rocked up" before their respective tests, that is, each well was closed in for a period of at least 24 hours before the start of its test. This had been the procedure of the company mentioned in running their tests, the results of which were the V-type curves. In view of the long period of time necessary for stabilization, it was felt that this "rocking up" was causing an abnormal condition in the reservoir surrounding the well which would not correct itself during a reasonable length of time without a heavy pull on the well. Consequently, two wells were chosen that were being produced normally and tests were made on them. The wells were closed in after the tests to get the closed-in pressure for the calculations. The results were exceptionally good and are shown in Fig. 7A, curve *G*, and Fig. 7B, curve *M*.

During these tests each point was stabilized a considerable length of time. This led to the possibility that if each point was given 24 hours stabilization a number of wells could be tested concurrently and with none of the wasted time incurred in waiting at one well. Of the 11 wells tested concurrently, Fig. 7A (curves *A* through *F*) and Fig. 7B (curves *H* through *L*), by this method some were very satisfactory and some were not.

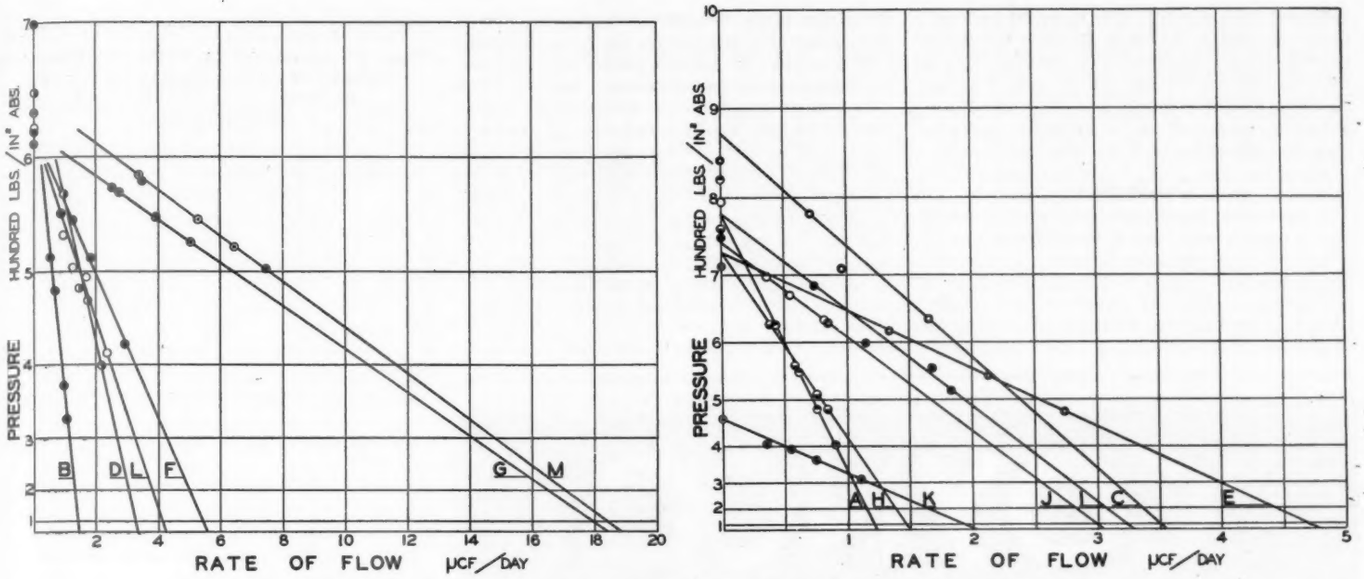
Another difficulty encountered in interpreting the tests was in ascertaining whether the correct shut-in pressure had been obtained. In a majority of the wells the pressure will continue to rise for several days after closing the well in and the amount that it will rise per day will be irregular and affected by offset operations. Table 6 is an example of the irregularity of the shut-in pressures in the field, one column showing the closed-in pressure on the wells tested after being

TABLE 6—VARIATION IN CLOSED-IN PRESSURES OF THE WELLS OF FIGS. 7A, 7B, 8A, 8B, AND TABLE 7

Well—	48 hours closed-in pressure at time of test (lb./sq. in. gage)	24 hours closed-in pressure 2 months later (lb./sq. in., gage)
A	808	795
B	684	670
C	828	825
D	634	670
E	698	710
F	605	605
H	746	725
I	735	735
J	780	755
K	448	455
L	608	610



Figs. 7A, 7B—Results of tests conducted on wells being produced normally instead of being "rocked up" before the tests



Figs. 8A, 8B—Results of tests plotted in Figs. 7A and 7B when plotted as productivity tests

shut in for 48 hours, and the other column being the closed-in pressure 2 months later after a 24-hour shut-in.

The cause of slow stabilization for small wells is low permeability which is inherent in the reservoir, and is not subject to control. This is not meant to convey that satisfactory back-pressure tests cannot be made in the field, but that the regular procedure of testing would necessitate impractical periods of time.

Recapitulating, it has been established that in the Monroe field the actual blowing of wells to the atmosphere clearly gives unreliable results and involves a pointless waste of gas. The regular back-pressure test is impractical because of the time involved and shortening of the tests leads to unreliable results. With these thoughts in mind, the authors have evolved a test which for the purpose of this report will be called the "productivity test." As will be seen, the productivity test is merely a simplified back-pressure test, which has many of its advantages and partially eliminates the practical disadvantages encountered in the Monroe field.

The data of the test are plotted on a special graph on the productivity well-test form shown in Fig. 9. The vertical scale is constructed to automatically plot the square of the absolute pressure without any calculation. The horizontal scale is a regular linear scale representing the rate of flow.

The basis of this special graph is that a test plotted on it is a straight line provided $n=1$ in the general equation governing a gas well,

$$Q = C(P_t^2 - P_s^2)^n$$

Where:

Q = producing rate of flow at sand-face pressure of P_s
P_s = sand-face pressure at a rate of flow of Q
P_t = closed-in formation pressure
C = a constant for any particular well
n = a constant for any particular well

For then, at absolute open flow, $P_s=0$, and therefore,

$$Q_{o.f.} = C P_t^2 \quad \text{or} \quad C = \frac{Q_{o.f.}}{P_t^2}$$

and in general when $n=1$,

$$Q = \frac{Q_{o.f.}}{P_t^2}(P_t^2 - P_s^2), \quad \text{or,}$$

$$Q : Q_{o.f.} = (P_t^2 - P_s^2) : P_t^2$$

which by similar triangles shows the test to be a straight line on this graph. Fig. 9 has two vertical scales arranged so that the one giving best spread of data may be used. Inspection of the vertical scale of the form in one position and when the form is inverted will indicate the best scale to be used in any given test.

The data necessary are the working pressures and respective rates of flow at two different producing rates. The points should be taken such that the working pressures are pulled down approximately 10 and 50 per cent from the closed-in pressure. The closed-in pressure may be used as a point in place of the 10 per cent pulldown point, if it is felt that the closed-in pressure is reliable. However, the thought is offered that the independence of this test from the closed-in pressure is an advantage, as closed-in pressures are more susceptible to error due to offset operations, as has already been mentioned.

The simplicity of the productivity well-test form facilitates its use directly in the field or office without the need of calculations, excepting the rate of flow of gas from the orifice-meter readings. The atmospheric pressure must be added to each gage pressure, however, as all pressures must be expressed in pounds per square inch absolute. It is not necessary to account for the weight of the gas column if the gas is assumed to obey the ideal gas laws; this may be easily verified by following through the above derivation, substituting for each bottom-hole pressure the corresponding surface pressure multiplied by $(1+a)$ where a is a constant accounting for the weight of the gas column. The friction-pressure drop in the tubing need not be considered since the surface pressures are measured on the casing, in which there is a dead-gas column.

The assumption of an n factor of unity can probably be justified, as unity is very near the average n factor of the field. No attempt has been made to establish the average n factor but from the information available on the wells in the discussion, an arithmetical

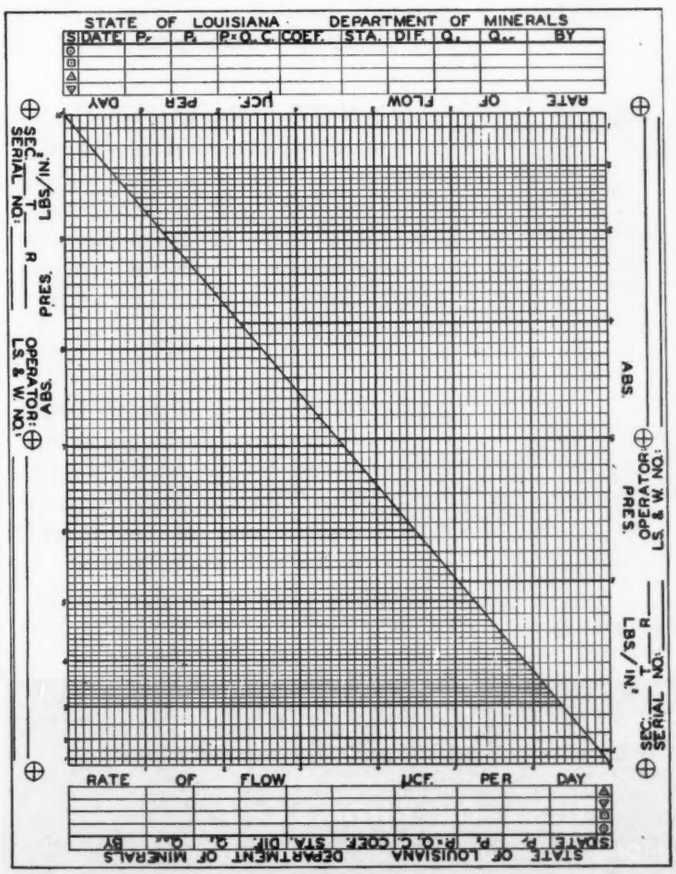


Fig. 9—Productivity well-test form on which data of the test are plotted

average n factor of 1.03 or a weighted average n factor[9] of 0.963 is obtained. To illustrate the reliability and practicability of the productivity test, the tests of Figs. 7A and 7B are plotted as productivity tests in Figs. 8A and 8B. Table 7 compares the results of the productivity, back-pressure, and pitot-tube tests on these wells.

Conclusions

In conclusion, the productivity test is shown to give a reliable gage with a minimum of time. It is practical for one man to obtain productivity tests concurrently on 15 to 20 wells over a period of 2 to 3 days. Thus, it requires about the same amount of time to gage all the 1,300 wells in the Monroe field as is required by pitot-tube open flow, that is, on the assumption that in front of and behind the man making the pitot-tube measurements there are crews breaking down the connections on the wells and making them up again.

The simplicity of the productivity test allows widespread use in office and field. It is not a "spot" test; in fact, it shows the characteristic of the well over its whole operating range and allows a simple check on itself by obtaining another working pressure and rate of flow in case there is reason for suspicion of error in any given test. It is not merely a test for arriving at the open flow; it has very practical operating use. Routine company inspections of wells usually check operating pressure and rate of flow, which can be recorded on the productivity-test form and would immediately reflect the condition of the well. Thus, trouble might easily be detected.

To the pipe-line dispatcher the form gives immediate information without calculations. It quickly gives reliable gas-availability information on all a company's wells in the field or on a group of wells on a particular field gathering loop. It allows the prediction of the future availability as the reservoir pressure declines.

Besides the data of this report in establishing the reliability of the productivity test, the possible applications of it in regular production practice add in confirming it as a true indicator of the ability of a well to produce gas.

TABLE 7—GAGES ON 13 WELLS, SHOWING THE COMPARISON OF THE RESULTS OF THE PRODUCTIVITY, BACK-PRESSURE, AND PITOT-TUBE TESTS

Well—	Open flow, μ cu. ft./day			Per cent error in	
	Q_p	$Q_{b.p.}$	$Q_{p.t.}$	Q_p	$Q_{p.t.}$
A	1.23	1.27	2.46	−3	+94
B	1.46	1.49	6.39	−2	+328
C	3.55	3.15	10.31	+13	+227
D	3.35	3.26	11.1	+3	+240
E	4.78	4.60	12.2	+4	+165
F	5.58	5.26	11.9	+6	+126
G	18.40	16.8	16.16	+9	−10
H	1.50	1.62	4.06	−7	+150
I	3.28	3.22	8.62	+2	+168
J	3.04	4.59	7.06	−34	+34
K	2.02	2.06	5.59	−2	+171
L	4.24	3.77	11.1	+12	−194
M	18.80	18.5	17.11	+2	−8

Q_p = open flow from productivity test, μ cu. ft./day
$Q_{b.p.}$ = open flow from back-pressure test, μ cu. ft./day
$Q_{p.t.}$ = open flow from pitot-tube test, μ cu. ft./day
Per cent error in Q_p and $Q_{p.t.}$ based on $Q_{b.p.}$ being correct.

Acknowledgment

The authors are grateful for and wish to acknowledge the cooperation of the operating companies in the Monroe field and their personnel extended to them during this investigation. Permission of the Department of Minerals to publish this report of investigation is appreciated.

Bibliography

1. Fergus, Preston. Monroe Gas Field, Louisiana. Geology of Natural Gas, American Association of Petroleum Geologists; June 1935.
2. Bell, H. W. The Monroe Gas Field, Bulletin 12, Louisiana Department of Conservation, 1926.
3. Lichty, L. C. Measurement, Compression, and Transmission of Natural Gas: John Wiley & Sons, New York, 1924, p. 74-78.
Diehl, John C. Natural-Gas Handbook: Metric Metal Works, Erie, Pa., 1927, p. 291-92.
Westcott, Henry P. Handbook of Natural Gas: Metric Metal Works, Erie, Pa., 1920, p. 254-58.
4. Reid, Walter. Open-Flow Determination of Gas Wells. Western Gas. Nov. 1929, p. 15-19.
5. Rawlins, E. L., and Schellhardt, M. A. Back-Pressure Data on Natural-Gas Wells and Their Application to Production Practices. Monograph 7, Bureau of Mines, Department of the Interior. Aug. 1935. Appendix 4, p. 127-40.
6. Fuelhart, D. E. Natural Gas Flow Tables. Information Circular 1, Louisiana Department of Conservation. Aug. 1937. Also The Oil and Gas Journal, Jan. 20, 1938, p. 97-99.
7. Bell, H. W. The Monroe Gas Field. Bulletin 12, Louisiana Department of Conservation, p. 33; 1926.
8. Muskat, M. The Flow of Homogeneous Fluids Through Porous Media: McGraw-Hill Book Co., New York, 1937, p. 708-12.
9. White, Paul C. Estimating Availability of Natural-Gas Reserves. Petroleum Engineer, Dec. 1940.

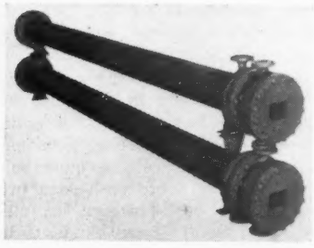
Portable Spudders Used for Deepening Wells at Salem

(Continued from Page 199)

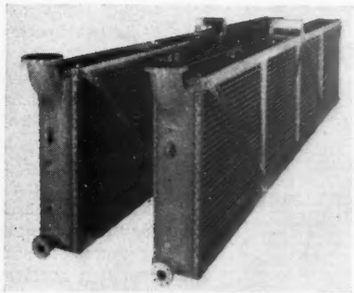
is quite hard on stems and bits. Jumped pins and backoffs are quite common, but fishing jobs are not complicated by caving holes and other troubles. For fishing, the regular friction or pin socket is used on long-stroke jars. Annealing of the joints has been helpful in reducing this trouble. The formation in Illinois seems to be as hard on bits and stems as any place in the country.

"COYNCO"

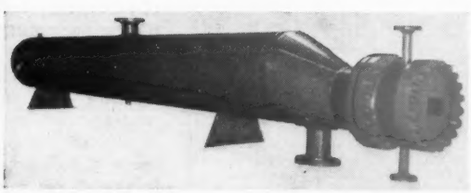
Heat Exchangers in the Refinery



"COYNCO" Shell and Tube Heat Exchanger units showing the conventional design and arrangement as to tube bundle channel, assembly, connections and general workmanship.



"COYNCO" Stratube Submerged Sections. Note sturdy construction. Hot dip Galvanized steel framework after fabrication. Removable Tube supports. Separable tube sheet and cover header design. Complete with lifting rack—All Coynco Standards.



"COYNCO" Kettle-Type Reboiler, fabricated in our shops to API-ASME Code. This "Coynco" Reboiler is in use in one of the larger Mid-Continent refineries.

"Coynco" engineering facilities assure our customers of all the latest developments in Shell and Tube practice. We invite your inquiries concerning heat exchanger problems.

Joseph A. Coy Co., Inc.

3515 Dawson Road Phone 3-9196

TULSA, OKLAHOMA

Branch Office—304-305 Rule Bldg., Amarillo, Texas

At the start of the deepening program it was believed that it might be necessary to seal off the productive Devonian lime. In the few cases where rotary rigs have been used, this has been the case, but with cable tools it is not necessary. The tubing is pulled from the hole and the hole cleaned to bottom before drilling is started. During the drilling, the hole remains full of oil up to and above the Devonian.

The most troublesome section is the Maquoketa shale, immediately above the Trenton lime. The section is about 200 ft. thick and is quite cavy, particularly if the oil is allowed to come in contact with it. The most successful method found to drill the shale is to use an Aquagel fluid. The Aquagel is made into a thin mixture and run in the hole in the bailer. The water courses on the bit are packed with thick Aquagel. Some contractors have the tool dresser make small balls of Aquagel and drop them in the hole while drilling is in progress. Drilling with a tight line through the shale section prevents caving and sticking of the bit.

Some Aquagel is used by most contractors for drilling through the lime section also, the material being packed into the water courses on the bit just before running it in the hole. Main advantage is that it excludes the oil in the hole from the formation and makes fishing much easier as the hole is kept clean. On most fishing jobs it is merely a matter of running in and picking the fish off bottom.

Length of stroke and the motion used varies with different operators and different drillers. The type of machine employed also influences this part of the drilling. With a good machine and crew from 30 to 70 ft. per day will be made.

Gas escapes from the hole during the drilling below the Devonian and it is necessary that machines be fireproof to prevent explosions and destruction of the drilling equipment and derrick.

Completions

Practice has been to set about 1,300 ft. of 5-in. liner a short way (from 7 to 10 ft.) in the top of the Trenton lime. The liner is hung in the 7-in. casing and cemented in place. Where a smaller upper string has been installed, the liner is 4 in. in diameter. Clearances are not large but they are sufficient to get the liner in place without too much trouble. A backoff tool on the tubing allows the liner to be put into place.

There has been considerable thought put on the cementing of the liner in place. As there are two sizes of pipe in the hole, it is impossible to use the ordinary displacement method with a plug being pumped down on top of the cement. A balancing system was used for a time with a sonic measuring device being employed to detect the level of the cement behind the liner. A later method is to use a special plug with a hole in the center supported by shear pins in top of the liner; after the cement has been pumped into the liner, a ball dropped down the casing seats in the hole in the plug. Application of pressure forces the plug down the inside of the liner with the cement being forced up and around the outside.

Practice at present is to shoot the wells with from 1 to 1.5 qt. per ft. of pay section. The wells may be swabbed both before and after shooting to obtain an idea of their productivity. This swabbing has been through tubing so far, but a revival of an old method may be tried. This is a double swab, the upper one fitting the 7-in. casing and having a hole through it for the swabbing line which is attached to the lower, or 5-in. swab. The lower swab fits into a special seat on the bottom of the upper swab. With this arrangement it is possible to swab the wells to bottom through the casing and liner.

BOOK REVIEW

*"ELEMENTS OF THE PETROLEUM INDUSTRY," edited by E. DeGolyer, price $5.**

This volume, sponsored by the Seeley W. Mudd Memorial Fund, contains contributed chapters by the editorial board and other outstanding authorities on various phases of the petroleum industry. The editorial advisory board consists of John M. Lovejoy, Hallan N. Marsh, H. H. Power, E. A. Stephenson, H. D. Wilde, and W. E. Wrather. The book is designed for the engineer, or even the nonengineer, who is possessed of a curiosity regarding the hows and whys of the oil industry.

Chapters deal with exploration, refining, producing, drilling, leasing, transportation, accounting, economics, and a review of literature on the petroleum industry. Practically all phases of operating practices are touched. Contributing authors, in addition to the editor and members of the editorial advisory board, include: A. B. Parsons, Stewart P. Coleman, K. C. Heald, J. C. Karcher, Rush Greenslade, Alexander Deussen, J. E. Brantley, John R. Suman, C. V. Millikan, M. Albertson, Paul D. Torrey, W. R. Finney, B. B. Howard, M. D. Stauffer, Walter Miller, Sidney A. Swensrud, Allan H. Hand, and Joseph E. Pogue.

*"Elements of the Petroleum Industry" may be purchased through the Book Department of The Oil and Gas Journal at the established retail price of $5, postage prepaid (extra outside the United States), and a copy will be forwarded promptly upon receipt of check or money order for that sum. Where payment is not provided, the book will be sent c.o.d. to avoid delay.

LOW FIRST COST

Here's why McEvoy's prices are the lowest consistent with quality equipment and overall economy.

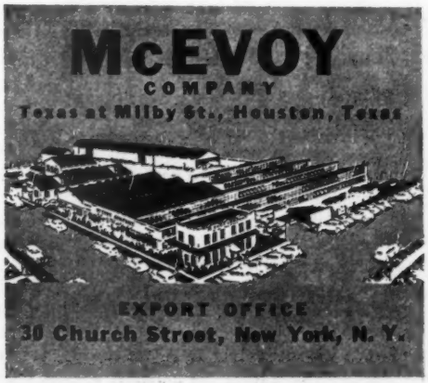
TO GIVE YOU LOW FIRST COST, McEvoy engineers simplify designs wherever practical. This simplification often has the added advantage of making McEvoy equipment more positive in operation and more dependable.

WORK TRAVELS FAST through this plant. Standardized designs and large volume permit us to use mass production methods which result in uniformly high quality and low prices.

UNIFORMLY HIGH QUALITY, resulting from mass production methods, reduces the loss from rejects and thus reduces the cost per unit.

COMPARE McEvoy prices. We believe you will be surprised at the low first cost of these products. Then order McEvoy Completion Equipment *for several wells.* Notice the high quality and extreme uniformity of these products. We believe that once you start using McEvoy equipment you won't stop.

SOLD THROUGH LEADING SUPPLY STORES EVERYWHERE



QUESTIONS ON TECHNOLOGY

By W. L. NELSON, TECHNICAL EDITOR

Units of Viscosity

Can you give us the relation between viscosity when designated in centistokes and the more commonly known designations such as centipoises or Saybolt Universal seconds?—R. T. R.

There are general relationships between viscosity measurements taken on various instruments such as the Redwood, Engler, Saybolt, etc., instruments, but the best policy is to test the oil in the particular instrument that is required, especially if the specifications of a shipment of oil are under consideration.

The relation between viscosity as centipoises and as centistokes is relatively simple. In fluid mechanics, the viscosity usually appears mathematically in association with the specific gravity. Thus, the viscosity in centipoises divided by specific gravity (at same temperature) is called the kinematic viscosity, and its unit is centistokes.

$$\text{Kinematic visc. (centistokes)} = \frac{\text{Centipoises}}{\text{Specific gravity}}$$

The relation of viscosity in centipoises or centistokes, to the Universal Saybolt viscosity is less definite. Nevertheless, the U. S. Bureau of Standards suggests the following relation:

$$\text{Kinematic viscosity} = \frac{Z}{S} = 0.219t - \frac{149.7}{t}$$

in which Z is viscosity in centipoises, S is specific gravity at the same temperature as the viscosity measurements, and t is the Universal Saybolt time in seconds.

The A.S.T.M. has adopted a standard table for converting Universal Saybolt viscosity to kinematic viscosity which is given as Designation D446-39 in Petroleum Products and Lubricants of the American Society for Testing Materials, 260 South Broad Street, Philadelphia, Pa. This is probably the most highly respected set of conversion factors that is available.

For greater convenience, however, you could refer to Pages 46 and 47, Pages 163-65 and Fig. 39 in "Petroleum Refinery Engineering," which is published by the McGraw-Hill Book Co., and may be obtained from the Book Department of The Oil and Gas Journal.

Identification of Oil Additives

Could you tell us if there is any method of systematic identification of additives in lubricating oils?—J. C. L.

Such a large number of additive agents are employed that a systematic method of identifying the additives—or in other words, of analyzing the oil qualitatively—would be extremely complicated and perhaps impossible at the present time.

Superficially, certain materials or elements can be identified by means of standard qualitative tests. Among such elements or materials are chlorine, bromine, or iodine which can be detected by the blue-green discoloration of the flame produced by a clean copper wire which has been dipped in the oil. Sulfur or sulfur compounds can be detected by heating the material with metallic sodium in an ignition tube, and noting the black discoloration that is produced on a silver coin when the ignition residue is moistened with water. Finally, saponification number of the oil can be determined by the A.S.T.M. Designation D94-39T or similar methods. If the oil contains only one kind of vegetable or animal oil, the saponification number can be used to determine the amount of fatty oil that has been added.

The most comprehensive treatise on organic analysis is Allen's Commercial Analysis which is published in eight volumes with current supplements. By careful study of these books it should be possible to outline a program of identification. Perhaps the most difficult part of such an analysis would be the separation of the addition agent from the oil.

Identification is difficult because usually an extremely small amount of additive agent is employed and because so many additives may be used. A few of the additive agents that have been mentioned are as follows:

Oiliness and wear-prevention agents:
Tricresyl phosphate
Dibenzyl disulfide
Oleic acid
Stearone
Copper oleate
Triphenyl phosphine, arsine, arsenite, stibine, and phosphine sulfide
Tetrabenzyl or tetraphenyl silicon
Phosphonitrilic chloride
Mesityl heptadecyl ketone
Tristearin
Castor, lard, neatsfoot, and sperm oils
Fatty acids or their glycerides
Diphenyl and diphenylene oxides

Antioxidants:
Phosphite esters
Hydroquinone
Acrolein
Beta naphthol
Aryl-alkyl-metallo-organic compounds
Alkyl phenol-polysulfides
Mono-, di-, and triphenylamines, ethanolamines
Aminoethyl methacrylate
Butyl and amyl-phenol thioethers
Esters of alkyl xanthates

Pour-point inhibitors:
Aluminum stearate
Ketones (high mol weight)
Voltolized oils

Viscosity index improvers:
Butene polymers
Linear types of compounds as rubber, hydrogenated rubber, and certain cellulose esters and ethers
Lead oleate

Detergents:
Voltolized fatty oils (Elektrion)
Alkali metal soaps
Aluminum naphthenate
Calcium soaps of phenyl stearic and dichlorostearic acid.

Stormer and Other Viscosity Units

Can you furnish us with information concerning the conversion of Stormer viscosity units into Furol viscosity units?—S. N. M.

The Stormer method as well as most other commercial methods of measuring viscosity is based on some empirical measure of the thickness of the fluid such as the time of flow or the power to cause movement in the fluid. The Stormer instrument and its operation is described in the 1937 edition of Practical Petroleum Engineers' Handbook, by Zaba and Doherty. The instrument consists of a vertical shaft having mounted on it a spindle (or paddle wheel) which can be rotated in the material that is being tested. The power to cause rotation is generated by means of weights. Obviously, the rate of rotation governs to some extent the power (or weight) required to cause the rotation and hence the relation between Furol viscosity and Stormer weight is a function of the speed of rotation. The following tabulation illustrates the approximate relation for three speeds of rotation:

Viscosity—		Stormer viscosity, grams, at these speeds				
Centi.	Furol	100 r.p.m.	300 r.p.m.	500 r.p.m.	600 r.p.m.	1,000 r.p.m.
10	12	16	44	88	104	213
30	19.5	31	94	168	203	
50	27	47	143	250	305	
70	36	63	193	...	...	...
100	49.5	87	267	...	...	...

It should be noted that this tabulation is only an approximation, because a complete chart showing all values rather than a few scattered ones, is what is required and because the Stormer instrument should be calibrated for use by testing glycerol solutions of known concentrations. Complete data on the viscosity of glycerol solutions are available in the International Critical Tables. Accurate values of the relation between Furol seconds and centipoises can be obtained in Petroleum Products and Lubricants published by the American Society for Testing Materials, 2600 Broad Street, Philadelphia, Pa.

Note that the relationship indicated in the table applies at any temperature—that is, all viscosity measurements must be taken at the same temperature. If in addition, you wish to compare Furol seconds (at say 122° F.) with Stormer weights at other temperatures, it will be necessary to convert the Furol viscosity to the temperature of the Stormer readings. This may be accomplished by means of special charts which are also available through the A.S.T.M.

Cost of Light-Oil Treating

I would appreciate any information you may have on the cost of refining straight-run gasoline, kerosene, and distillate, also the treating costs of each product.

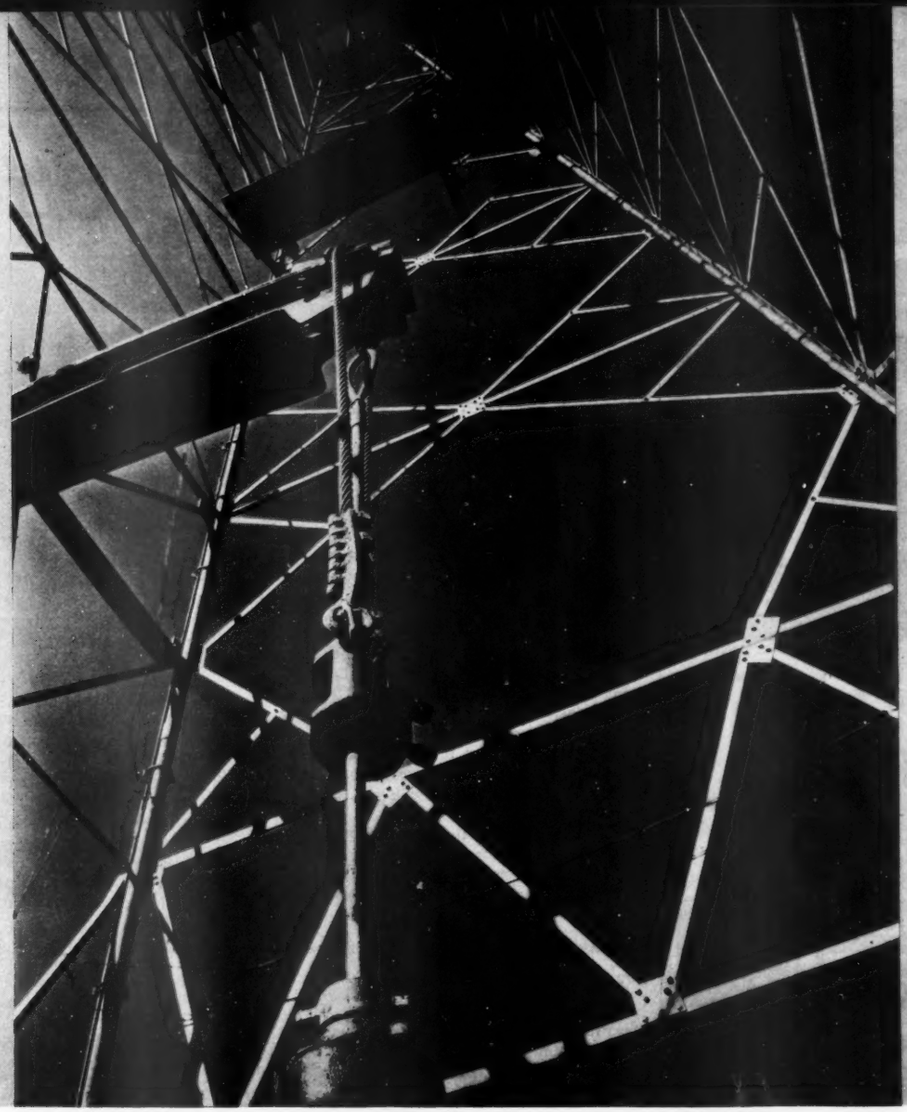
The cost of chemical treatment varies widely because of the different equipments that may be employed, because of variations in crude oils and because of different degrees of efficiency in managing the treating operations. For these reasons only very approximate values can be given and the range of cost will be so large that the figures are of little significance. The way to avoid such confusion is to adopt what appears to be the most suitable treating methods for your particular stocks by advising with consulting engineers, and then to determine costs.

Costs that will appear in the Second Edition of Petroleum Refinery Engineering, which will be published this year, are as follows:

Acid treating, complete	1.7-4.5 cents per bbl.
Doctor sweetening	0.8-3.0 cents per bbl.
Copper sweetening	0.7-1.0 cents per bbl.

These costs may be used for any of the light oils except that copper sweetening has not as yet been used extensively for kerosene or distillates.

Much the same situation exists regarding the cost of topping or skimming distillation. The cost will usually range between 5 and 19 cents per barrel of crude oil.



THE POLISHED ROD CATCHES IT COMING AND GOING

What with the entire weight of the sucker rod hanging on it and continuous alteration between tension and compression, the polished rod has no easy time of it even under normal conditions. And, of course, if it fails there is grief of assorted kinds in large quantities.

The service calls for steel that combines ductility with fatigue strength and toughness in a high degree. Chrome-Molybdenum "4130", properly heat treated, has exactly that combination of properties, as many well operators have learned to their advantage.

This use of Chrome-Moly for polished rods is typical of many applications of Molybdenum steels to reduce costly interruptions due to failure. Our book, "Molybdenum Steel in Oil Production," which will be sent free on request, gives complete information about these modern steels for modern needs.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • CALCIUM MOLYBDATE

Climax Molybdenum Company
500 Fifth Avenue, New York City

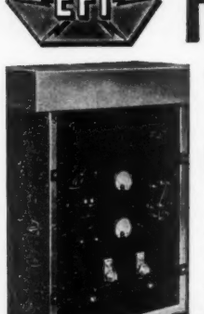
MOLY

CRC

PIPE LINE
CONSTRUCTION
EQUIPMENT

CRUTCHER-ROLFS-CUMMINGS
Pipe Line Equipment and Materials
Houston, Texas, U. S. A.

EFI REXSELEN
REGISTERED U.S. PATENT OFF.

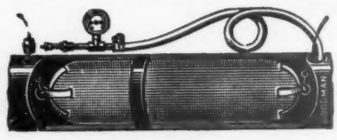


CATHODIC CORROSION
Eliminators
OFFER YOU
THE CORRECT TYPE
AND CAPACITY
TO ECONOMICALLY
ANSWER EVERY
PIPE-LINE NEED

WRITE TODAY FOR FULL DATA

REXSELEN ELECTRICAL FACILITIES, Inc.
4226 Holden St. OAKLAND, California
Factory Distributors of I. T. & T. Selenium Rectifiers

STOPPERS
FOR
OIL AND GAS LINES



Send for catalogue
SAFETY GAS MAIN STOPPER
COMPANY
523 Atlantic Ave. Brooklyn, N. Y.

Pipe-Line Activity

Georgia May Reconvene to Consider Pipe-Line Bill

Despite a telegram from President Roosevelt advocating legislation to permit construction of gasoline pipe lines, the Georgia Senate voted down the legislation on March 19.

Debate on the bill to give a corporation right of eminent domain in obtaining right-of-way was halted to hear the 1,000-word telegram to Governor Eugene Talmadge, from the president, advocating pipe-line construction as vital to national defense.

The bill contained a provision that right of eminent domain should be given if the president, secretary of war or Navy proclaimed it essential to national defense. The vote against the bill was 27 to 21.

The president's message approved the partially constructed line of the Southeastern Pipe Line Co., which now extends from Port St. Joe, Fla., to Bainbridge, Ga., and would continue to Chattanooga, Tenn., and the proposed Plantation Pipe Line Co. system from Baton Rouge, La., to Norfolk, Va.

After defeating passage of the bill, the senate adopted a resolution expressing willingness to reconvene in special session to enact pipe-line legislation permitting the federal Government to construct pipe lines in Georgia. The regular session of the legislature ended March 22.

The resolution said the senate wanted to cooperate in the national-defense program, but did not want to give private corporations the right to condemn private or public property in laying pipe lines.

Socony-Vacuum Awards Contracts For Topeka-Sioux City Line

Socony-Vacuum Oil Co., Inc., White Eagle Division, has awarded contracts for the construction of a gasoline and refined-products line from Topeka, Kans., to Sioux City, Iowa. This line will connect with the company's gasoline trunk line from its refinery at Augusta, Kans., to Kansas City.

The new line will consist of approximately 250 miles of 6-in. Three contracts have been awarded as follows: Section 1, 68 miles, extending northeast from Topeka will be laid by Midwestern Engineering & Construction Co.; Section 2, 91 miles, Oklahoma Construction Co. (a T. R. Jones organization), and Section 3, 90 miles of line terminating at Sioux City, Iowa, Jones & Brooks, Inc. Work will commence May 15 and it will be completed in 60 days.

Natural Gas Pipeline Co. Plans 185 Miles of Loops

Natural Gas Pipeline Co. of America is preparing to construct two loops totaling 185 miles of 26-in. on the main trunk line from the Texas Panhandle to Chicago. One section of 101 miles will extend northeast from a point near Nebraska City, Neb. The other section of 84 miles will be laid in eastern Iowa to the Illinois line. Pipe deliveries are expected to start April 14.

The two loops are part of an expansion program of the company planned for this year. Contracts for construction of several loops on the line have been already awarded.

Government Desires Construction Of Plantation Pipe Line Project

The United States Government may act shortly to permit construction of one of the greatest gasoline pipe-line projects in the world. The proposed pipe line, construction of which was barred last week by a vote of the Georgia Senate, would be 1,261 miles long, extending from Baton Rouge, La., to Greensboro, N. C.; it could be lengthened 225 miles more to Norfolk, Va., if the United States Navy desires.

Present plans call for the expenditure of $15,000,000 on the Baton Rouge-Greensboro construction and $2,250,000 more on the Norfolk extension.

The project is a joint operation of Standard Oil Co. of New Jersey, Standard Oil Co. of Kentucky and Shell Union Oil Corp. under the corporate setup of Plantation Pipe Line Co.

Plantation has been actively engaged for a year in obtaining a right-of-way. It is understood that the only serious difficulty experienced is with the railroads. Plantation applied to 24 railroads for permits to cross rights-of-way. All but one of the applications were refused.

With the exception of the 96-mile section of Southeastern Pipe Line Co. between Port St. Joe, Fla., and Bainbridge, Ga., no gasoline pipe line is in operation in the southeastern states. This area annually consumes two billion gallons of gasoline and receives it all by train, truck and ocean vessels. It is claimed that only 11 per cent of this amount is carried into the southeast by train alone, and that ocean tankers (mainly owned by the oil companies) get 89 per cent of the traffic to maintain distribution points.

The Government is interested in getting the pipe-line setup for three reasons:

(1) The establishment of an "interior line of supply" of a defense essential; (2) the elimination of long ocean-tanker hauls is important in order that ships may be used strictly as Navy auxiliaries; (3) a reduction in gasoline-transportation costs is expected.

Secretary of the Navy Knox said in Atlanta on March 13 that construction of a line from Baton Rouge to Norfolk is vitally necessary. He described the present ocean transportation of gasoline and fuel oil around Florida and up the coast as a "vulnerable point in our national defense" and said: "Such water transport in time of war would be in grave danger from submarine activity."

As the specifications for the pipe line now are drawn up, it could transport 48,000 bbl. of gasoline

B AND M CONSTRUCTION CORPORATION
BUILDERS OF PIPELINES
FOR THE
OIL AND GAS INDUSTRY
General Offices . . .
316-319 Petroleum Building
Phones 7-8844 — 8-2685
OKLAHOMA CITY, OKLAHOMA
Earl A. Benson, President
Wm. V. Montin, Secretary-Treasurer

If you haven't had that FREE list of important oil books, by all means send your request to the Book Department, The Oil and Gas Journal, Tulsa, Oklahoma.

Pipe-Line Personalities . . . . . William S. Jack

WILLIAM S. JACK, general superintendent, pipe-line department of National Refining Co., grew up in a family of oil producers at Lima, Ohio, who operated for two generations. After an active career as an independent producer in Pennsylvania, his grandfather participated in the development of the Lima, Ohio, field. Later Mr. Jack's father was also engaged there in oil production. Afterward his father was connected with Ohio Oil Co. in construction of gasoline plants. On graduation from high school at Casey, Ill., he worked in that vicinity for Ohio Oil Co. and Pure Oil Co. In April 1919, at the age of 19, he started with National Refining Co. and has been with this organization ever since. Following 3 years of construction and engineering work in operations of the pipe-line and producing departments in the vicinity of Beattysville, Ky., he went to Kansas. He studied engineering by correspondence course and by private instruction given by a construction engineer at Chicago. In 1921 he became superintendent of the Kansas district of the pipe-line department and drove the first stake for lines laid by the company in the state, which were later expanded to a system consisting of more than 300 miles serving the principal fields of Central Kansas. In 1939 he was transferred to Bartlesville, Okla., and became general superintendent in charge of the company's crude-oil pipe lines in Kansas and Oklahoma supplying National Refining Co.'s plant at Coffeyville, Kans.

daily jointly from the Standard of Louisiana refinery at Baton Rouge and the Shell company refinery at Norco, La. This would be carried consecutively through 435 miles of 11-in., 359 miles of 9-in., 214 miles of 6-in. and 253 miles of 4-in.

Construction of the line normally would require 7 to 8 months but it is understood officials think the whole job could be completed in 5 months.

Terminals have been planned for the following locations: Meridian, Miss.; Moundsville, Birmingham, Montgomery and Oxford, Ala.; Bremen, Columbus, Macon, Atlanta and Athens, Ga.; Belton and Spartanburg, S. C.; Charlotte, Salisbury and Greensboro, N. C., and Chattanooga and Knoxville, Tenn.

Nevertheless, the opposition of the railroads to the pipe line has been outspoken. In Georgia, the legislature declined to grant the right of eminent domain to the pipe line to permit the oil men to override the railroads' opposition.

In Mississippi and Louisiana, Plantation has gone to court in an attempt to get a ruling that the right of eminent domain, which in those states applies to "oil and gas pipe lines," should be interpreted to include gasoline pipe lines.

In Alabama, "public carriers" under the law can cross railroads, and Plantation has to prove in that state that a pipe line is a public carrier.

In South Carolina there is no law on the subject. In North Carolina, "local corporations" have the required right. Tennessee's laws give pipe lines eminent domain.

Globe Refining Co. Will Lay 200-Mile Gasoline Pipe Line

Globe Refining Co. is considering construction of a 200-mile, 6-in. gasoline pipe line from the company's refinery at McPherson, Kans., to Council Bluffs, Iowa. Work on the project may start some time in April.

Gas Line in Kansas Links Field With Cities Service

Aladdin Petroleum Co. and Bradley Petroleum Co. have laid a 9-mile, 6-in. line from gas wells north of McLouth, Kans., to the trunk line of Cities Service Gas Co.

Midwestern Contracts Work For Two Illinois Projects

Midwestern Engineering & Construction Co. has obtained a contract from the U. S. Government for taking up 63 miles of pipe which had been part of the trunk-line systems of Stanolind Pipe Line Co. and Sinclair Refining Co., pipe-line department, in the vicinity of the TNT plant which is being built near Wilmington, Ill. Pipe consists of 28 miles of 8-in., 28 miles of 12-in. and 7 miles of 14-in. The contractor is moving in and work starts this week.

Building of the munitions plant required the laying of new lines for these two companies as well as those of Texas-Empire Pipe Line Co. so that the trunk lines would follow a route which would not be close to the plant. The laying of new lines for Stanolind and Sinclair was done by Sheehan Pipe Line Construction Co. The laying and taking up of short lines for Texas-Empire was done by Midwestern Engineering & Construction Co., which is also engaged in laying 5 miles of 2-in. and 3-in. for Panhandle Eastern Pipe Line Co. in the vicinity of Atwood and Arthur, Ill.

ELIMINATE WORKING TANKS ...AND RESULTANT LOSSES

with BRODIE METERS

Above installation of Brodie Meters has eliminated need for investment in working tanks.

A net loss in hydraulic efficiency takes place when oil from trunk lines enters station working tanks. Losses due to evaporation likewise result from operations in open or partially protected systems. Brodie Meters prevent these losses and eliminate the need for working tanks by furnishing a complete and accurate check of trunk line flow—continuously.

WRITE TODAY FOR BULLETIN 360A

FLOW CAPACITIES UP TO 1428 BBLS. PER HR.

BRODIE METERS

WORKING PRESSURES UP TO 1,000 Lbs. Per Sq. In.

RALPH N. BRODIE CO., INC.
955 - 61st Street, OAKLAND, California, U. S. A.
Cable Address: "BRODICO" • *Division Offices:* Chrysler Building, NEW YORK CITY • 59 East Van Buren, CHICAGO • 2809 Canton Street, DALLAS, TEXAS
Representatives and Stocks in All Principal Cities

Clarence L. Boyd Co., Inc.

International Tractors
International Power Units
Bucyrus-Erie Equipment
J. D. Adams Road Machinery

Pipe Line Equipment
Trackson Pipe Layers
Pipe Line Supplies

Jacobs Cathodic Units

Equipment for lease or rent

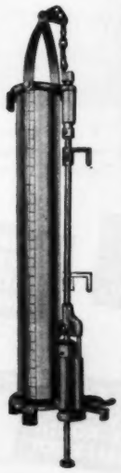
Clarence L. Boyd Co., Inc.
Tulsa, 3rd & Frankfort. Ph. 8191. L.D. 745
Oklahoma City, 17-19 West Pott.
Guthrie, 501 W. Oklahoma.

LUX CO.

OIL GAUGING AND FIRE FIGHTING EQUIPMENT

TULSA OIL THIEF
TULSA SAFETY GAUGING REEL
TULSA SAFETY HYDROMETER CASE
TULSA 6-VOLT CENTRIFUGE MACHINE, CAR TYPE
TULSA HOT WATER BATH, CAR TYPE
ALL TYPES OF EXTINGUISHERS FROM 1-QUART TO 5-GALLON
KIDDE LUX CO2 OR DRY ICE GAS EXTINGUISHERS
FOAM GENERATORS AND CHEMICALS
RECHARGES FOR ALL TYPES OF EXTINGUISHERS

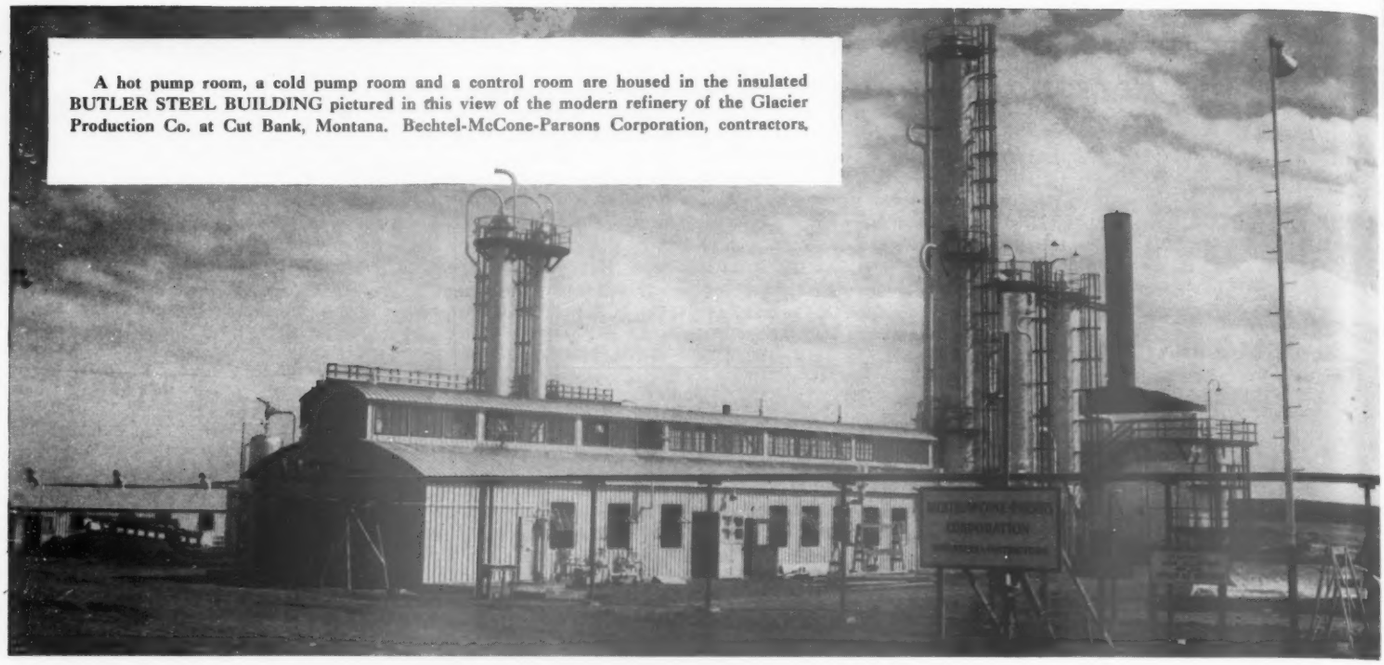
W. L. WALKER CO.
1001 SO. MAIN TULSA, OKLA.



SOMASTIC
REG. U. S. PAT. OFF.
PIPE COATING
POSITIVE and PERMANENT
PIPE PROTECTION

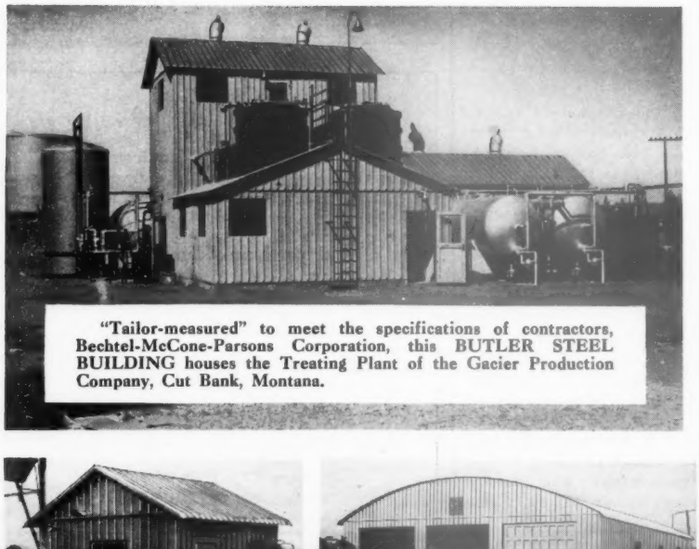
Select pipe with wall thickness commensurate with operating pressure, apply SOMASTIC Pipe Coating for its protection for the most economical and lasting pipe line installation.

INDUSTRIAL ENGINEERING CO.
Wilmington, Calif. P.O. Box 457
Houston, Texas P.O. Box 2091



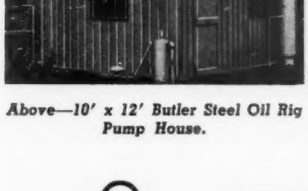
A hot pump room, a cold pump room and a control room are housed in the insulated BUTLER STEEL BUILDING pictured in this view of the modern refinery of the Glacier Production Co. at Cut Bank, Montana. Bechtel-McCone-Parsons Corporation, contractors.

BUTLER READY-MADE STEEL BUILDINGS

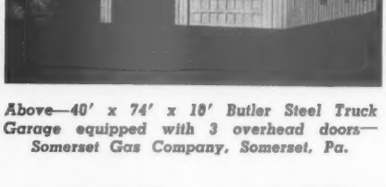


"Tailor-measured" to meet the specifications of contractors, Bechtel-McCone-Parsons Corporation, this BUTLER STEEL BUILDING houses the Treating Plant of the Gacier Production Company, Cut Bank, Montana.

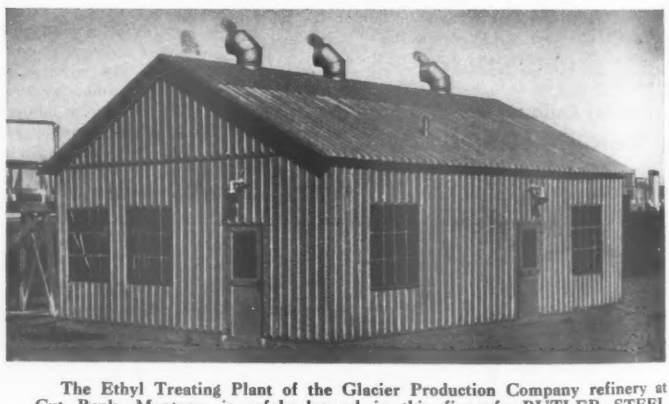
Refinery after refinery, in recent years, has been housed in Butler Steel Buildings. It is a trend so definite as to more firmly than ever establish Butler's exclusive design and construction as the standard throughout the oil industry. Throughout the oil fields, at recycling plants, at refineries, along pipe lines, at bulk stations and service stations are thousands of Butler Steel Buildings of all sizes and shapes "tailor-measured" from the Butler basic section-unit design. Factory pre-fabrication the Butler way gives greater strength per pound of steel—facilitates erection in days instead of weeks—cuts installation cost. First cost is low in comparison with other types of fire-safe, permanent structures. The best of long-life materials lower maintenance costs. For three-way savings on the best the market affords—SEND YOUR SPECIFICATIONS TO BUTLER ENGINEERS.



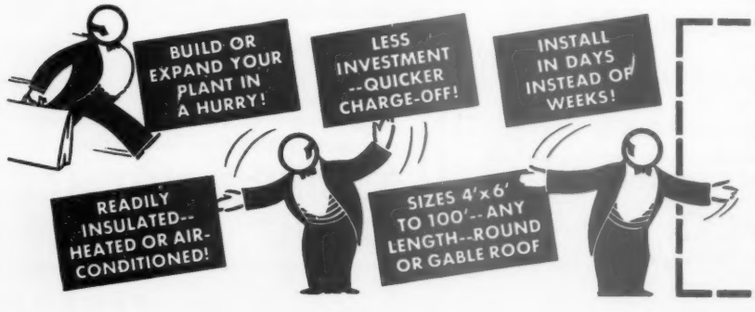
Above—10' x 12' Butler Steel Oil Rig Pump House.



Above—40' x 74' x 18' Butler Steel Truck Garage equipped with 3 overhead doors—Somerset Gas Company, Somerset, Pa.



The Ethyl Treating Plant of the Glacier Production Company refinery at Cut Bank, Montana, is safely housed in this fire-safe BUTLER STEEL BUILDING installed by Bechtel-McCone-Parsons Corporation, contractors.


BUILD OR EXPAND YOUR PLANT IN A HURRY!
LESS INVESTMENT --QUICKER CHARGE-OFF!
INSTALL IN DAYS INSTEAD OF WEEKS!
READILY INSULATED-- HEATED OR AIR-CONDITIONED!
SIZES 4'x6' TO 100'--ANY LENGTH--ROUND OR GABLE ROOF

BUTLER MANUFACTURING COMPANY

1244 Eastern Ave. KANSAS CITY, MO.

944 Sixth Ave., S.E. MINNEAPOLIS, MINN.

Send Butler Book of Steel Buildings and preliminary data on building ....

ft. x ..... ft. x ..... ft. to house .....

Firm Name .....

By ..... Address .....

City ..... State .....

FIELD DEVELOPMENTS...

HIGHLIGHTS FROM THE WEEK'S NEWS—

Completions show a slight gain over those of last week, with a net increase of 6 wells to 426. Reports from the Illinois fields were incomplete because of transportation difficulties and had they been normal would have raised present figures approximately 50 wells.

Although not in itself of commercial importance at last reports, the discovery of oil in the St. Peter in Northwest Pennsylvania will probably stir up quite a bit of excitement and, possibly, some activity. It is necessary, however, to bear in mind the liking of operators to transfer names from one district to another without necessarily having any geological basis. Having borrowed the term "Trenton" from Ohio for use in Illinois, it may be only logical that they should borrow "St. Peter" from the latter state. The similarity between the St. Peter of Illinois and the Wilcox of Oklahoma has been the cause of many tests of the former formation. None of these have found oil. Opinion has been current among many Ohio geologists that not only has no oil been found in the St. Peter in that state but that the St. Peter itself has not been found. The formation underlying the Trenton is sandy and carries water in many places but does not resemble the true St. Peter in the same way that roughly correlative sands do in Kentucky.

ILLINOIS: Completions this week were far below normal, probably due mainly to difficulty in moving around in the Illinois spring. White County leads in activity with two new fields and McClosky lime production in the South New Harmony field. The Benton pool is extended ½ mile west by a well finding saturation in the Tar Springs sand. Three more Trenton wells are completed in Salem, all for less than 200 bbl. (p. 230).

KANSAS: With production at a new high, a new pool was opened west of Kraft, which may prove to be an extension to that field. Another pool was added to Stafford County's growing list. Oil is found in the Arbuckle in the Stafford pool and also in an Ellis County test midway between Catherine and Ubert (p. 226).

NORTHWEST PENNSYLVANIA: After getting a show in the Trenton, Ohio's Erie County test drilled on to the St. Peter where it had a slight show of gas and oil. This is believed to be the first time that the St. Peter has been found in Pennsylvania (p. 216).

MONTANA: The Baker-Glendive structure, one of the most pronounced folds in the United States, will be tested by Carter with a 10,000-ft. well during the summer. Two of three tests formerly drilled on this structure yielded production from the Madison. Cut Bank has been extended ½ mile west to the south end (p. 236).

TEXAS GULF COAST: The Halls Bayou wildcat, 3½ miles east of Alta Loma, is preparing to test. La Ward is extended. The recent opening of the Lake Creek area, Montgomery County, deep in the Wilcox may cause a number of abandoned tests to shallower levels in that series to be reopened and deepened (p. 220).

NEW YORK-PENNSYLVANIA: The Oriskany sand fields in the northern Appalachian area are participating in the increased activity in gas development throughout the East (p. 238).

CALIFORNIA: Developments in the Castaic region and in the Sentous zone at Inglewood promise considerable activity during the year. Changes in drilling methods also encourage some operators to drill deep wells on 10-acre, rather than 20-acre spacing. Paloma is extended 1 mile southeast. With the return of good weather, the coastal district is expected to receive much more attention as several important wells are planned (p. 217).

WEST TEXAS: Crane County's deep Ordovician strike south of the Sand Hills Ordovician field and north of the Abell field of northern Pecos County is testing and promising to make a large well. New deep tests were staked in Pecos and in Reagan counties, the latter location projected to the Ordovician level. The Slaughter field was given two major production extensions during the week, one in the Hockley County portion and one in the Cochran County portion of the field (p. 233).

EASTERN TEXAS: There is a total of eight wildcat tests either starting or being planned for the near future in the eastern Texas district. These wildcats are one each in Upshur, Wood, Rusk, Rains, Fannin, Van Zandt, Houston and Henderson counties. The Hawkins field of Wood County is well on its way to becoming a major oil field, with 17 drilling wells and 3 tests rigging up. A large number of drilling permits has been asked for in the townsite, some of which have been granted (p. 235).

WEST CENTRAL TEXAS: Humble Oil & Refining Co. has opened a new deep Caddo lime oil field in Throckmorton County with a large well. In Shackelford County a new shallow 840-ft. discovery was recorded. Jones County's closely watched wildcat between the Stith and Akard fields is being deepened in search of a more prolific level (p. 233).

NORTH TEXAS: In Cooke County, Texas Co. has apparently discovered a new shallow field at the 1,900-ft. level. A new and deeper pay was in prospect for the recently opened Harrold field in Wilbarger County, while the Fargo field in the same county was given a mile west extension to production (p. 214).

SOUTHWEST TEXAS: A Frio sand discovery is reported 3 miles from Refugio townsite. Clara Driscoll and South Clara Driscoll are joined by a test midway between the pools. Nichols, Benavides and Sun are all extended a short distance (p. 231).

LOUISIANA GULF COAST: A new pool is in prospect near Port Allen, West Baton Rouge Parish. If successful, it will be the first pool in the parish. The second well in Westwego is running considerably higher than the discovery which has been abandoned due to mechanical trouble (p. 239).

ARK-LA-TEX: While much leasing and geophysical exploration is taking place along the Wilcox trend, most new production and interest is centered in the gas fields, particularly along the Texas border and at McKamie (p. 228).

MICHIGAN: Gas has been found in the Michigan stray sand in Deerfield, Isabella Township, which may be either a new pool or an important extension to the Broomfield pool. Oil production continues to decline while wildcat discoveries give disappointing results (p. 241).

COMPLETIONS IN ALL FIELDS . . .

(Week Ended March 22, 1941)

	Oil	Gas	Dry	Total	1941 total comp. to date	1940 total comp. to date
N. Y., Pa., and W. Va.	52	17	3	72	927	822
Ohio	14	12	5	31	303	186
Indiana	7	0	8	15	89	61
Kentucky	2	6	2	10	112	79
Illinois	6	0	5	11	585	724
Michigan	6	1	10	17	184	278
Kansas	24	3	11	38	355	291
Oklahoma	11	0	7	18	287	359
Nebraska	0	0	0	0	17	0
Texas:						
North Central Texas	21	1	25	47	545	663
West Texas	29	0	1	30	403	454
Texas Panhandle	10	0	0	10	107	129
Eastern Texas	16	3	3	22	235	178
Texas Gulf Coast	11	3	5	19	221	284
Southwest Texas	22	0	10	32	333	484
Total Texas	109	7	44	160	1,844	2,192
North Louisiana	4	0	2	6	129	123
Louisiana Gulf Coast	8	0	4	12	176	162
Total Louisiana	12	0	6	18	305	285
Arkansas	1	0	3	4	36	44
Mississippi	2	1	0	3	37	16
Montana	3	0	0	3	54	28
Wyoming	0	0	1	1	30	32
Colorado	0	0	0	0	6	5
New Mexico	3	0	2	5	68	140
California	18	0	2	20	231	216
Total United States	270	47	109	426	5,470	5,758
Total previous week	286	46	88	420		
Week ended Mar. 23, 1940	372	28	99	499		

NORTH CENTRAL TEXAS

By
R. MARNE SANFORD

Discovery North of Muenster, Cooke County, in Prospect

WICHITA FALLS, Tex., Mar. 24. — With activity shifting from the deep exploration throughout Clay and Montague counties which has centered in the district for the past several months, the spotlight was focused the past week on a possible wildcat discovery in Cooke County and on an indicated deeper-pay discovery for the recently opened Harrold field in Wilbarger County. Both the Fargo field in Wilbarger County and the Seymour field in Baylor County were receiving outpost extension tests.

Five miles northwest of Muenster in Cooke County, Texas 1 Bindel, Francis Hughes Survey, drilled broken sand showing oil from 1,885 to 1,890 ft. The wildcat was then cored from 1,890 to 1,896 ft. with recovery of 1½ ft. of sand showing oil. A drill-stem test with packer at 1,885 ft. and total depth of 1,896 ft. recovered 1,510 ft. of oil and 90 ft. of oil-cut mud in 30 minutes. Electrical survey was made of the hole and casing was set at 1,885 ft. At last reports the company was rigging up spudder to drill plug from the 5½-in. casing. Neighboring leaseholding companies are reported to be sharing in the expense of the test, which is strictly exploratory with no contract depth stated at the time of starting.

Harrold field.—Indicating a new and deeper pay level for the Harrold field of Wilbarger County, Charles Kadane 1 Schaffke, Section 3, Block 14, H.&T.C. Survey, 2 miles west of Harrold, is swabbing through tubing after drilling plug early in the week. The test missed the regular 2,900-ft. pay of the field's discovery well and found shows of oil in sand from 3,165-74 ft. Casing was cemented on top of the sand and when plug was drilled oil rose 800 ft. in the hole in 12 hours. The field's discovery well was by Big Six Oil Co., completed only 2 months ago.

SUMMARY OF COMPLETIONS

North Texas

	No.	Bbl.	Footage
Oil: Voth	3	550	3,883
Wichita	2	115	2,635
K.M.A.	4	1,400	17,305
Wildcats	1	65	1,550
Other fields	6	889	24,815
Dry: Fields	7	.....	7,073
Wildcats	8	.....	29,305
Total	31	.....	86,566

West Central Texas

Oil: Fields	3	198	4,757
Wildcats	2	265	4,156
Gas: Wildcats	1	*29.0	1,664
Dry: Fields	4	.....	4,733
Wildcats	6	.....	14,006
Total	16	.....	29,316

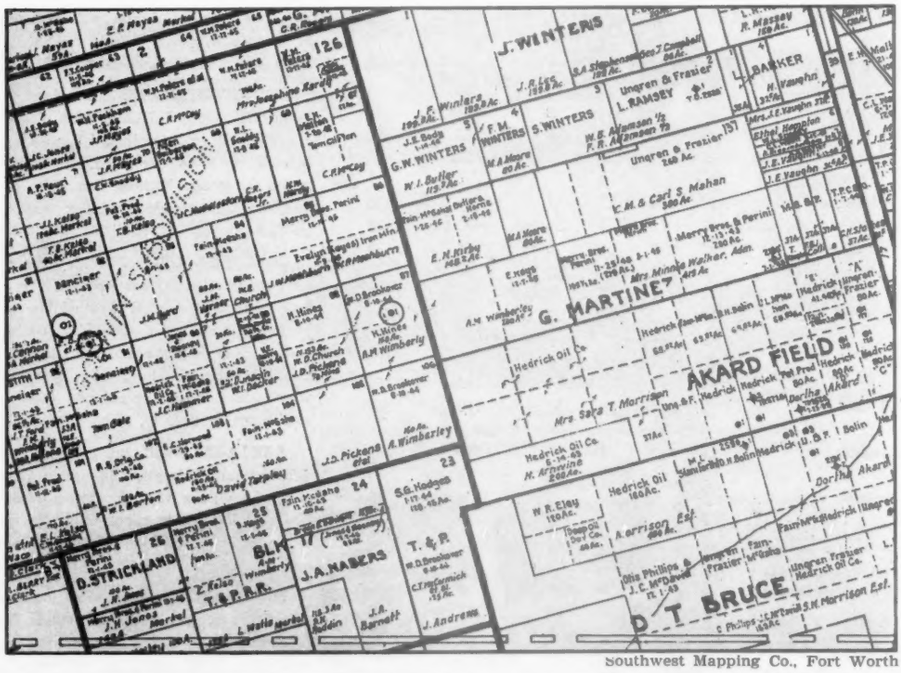
*Million cu. ft.

Field-Extension Locations

A 1-mile west extension to the Fargo field of northern Wilbarger County will be sought by Amerada Petroleum Corp., discoverer of the field, at a location staked as 1 Mrs. F. M. Condon, SE Section 22, Block 15, H.&T.C. Survey. The site on which operations will commence at once is due west of Humble 1 McCaleb, Section 34, which is drilling ahead below 3,575 ft. to test the area's 4,400-ft. producing level. This field has three prolific producing levels, with several wells completed from each horizon. As a ¼-mile south extension to the field, Amerada is completing 1 C. E. Sears, from saturation from 3,966-75 ft., total depth being 3,980 ft.

About ¾ mile east of production in the field Lewis Production Co. paid $180,000 for the 200-acre Daniel Bond tract in the north part of Section 46. The deal included $40,000 cash with the remainder out of oil. A location is expected to be made within a few days.

Seymour field.—Continuing its program of north-extension activity in the Seymour field of Baylor County, British American Oil Producing Co. last week purchased 1,800 additional acres out of the large Claude Cowan ranch north of Rendham. The acreage includes tracts in Sections 92, 91, 76, and 75, all acreage being about 4 miles north of the wildcat-field extensioner completed several months ago by the firm on the Claude Cowan ranch. The extension was about 2 miles to the north of the main body of the Seymour field.



Southwest Mapping Co., Fort Worth

The Akard and Stith areas in extreme southern Jones County are undergoing considerable development. Hines & Brockover 1 A. H. Wimberly between the two pools had production in the Cook sand and is being drilled deeper. In the Stith field, Swastika sand has been proved productive. Discovery wells are circled

NORTH TEXAS COMPLETIONS

Archer County

Wildcat: Deep Oil Development Co. and C. B. Christie 1 Moer, Sec. 21, Blk. 3, Clark & Plumb subd., top Caddo 5,336 ft., dry at 5,433 ft.
George Keith 1 Prideaux, Sec. 1867, T.E.&L. Sur., dry at 801 ft.
Jack Story, Jr., 1 Wilson, Sec. 86, Lot 4, A.T.N.C.L. Sur., 52 bbl. in 16 hr., pumping, est. 65 bbl. daily, 1,543-50 ft.
Consolidated Oil 1 Humphrey, E. S. Heath Sur., Abst. 176, top lime 4,046 ft., dry at 4,485 ft.
Home Oil 1 Spain, Sec. 8, Meade subd. 55, dry at 1,359 ft.
Archer field: Shappell Oil 6-E Jackson, dry at 620 ft.
J. H. Hardegree 1 Colgan, dry at 1,491 ft.
Hull-Silk field: J. H. Massie 23 Nichols, 18 bbl. an hour, pumping and flowing, 24-qt. shot, est. 40 bbl. daily, 4,389-4,415 ft.

Clay County

Clay field: Akin-Dimmock-Costley 9 McInnis, dry at 1,307 ft.
C. L. Gannaway 3 L. R. and F. Goetze, dry at 253 ft.
Wildcat: Carlos Wagner 1 Thaxton, Sec. 3, T.&N.O. Sur., Abst. 684, top Caddo 5,919 ft., dry at 6,133 ft.

Cooke County

Walnut Bend field: Sun 11 Snuggs, 76 bbl. in 6½ hr., est. 200 bbl., natural, daily, 4,908-21 ft.
Voth field: Humble 12 Hellman, 120 bbl. in 8 hr., est. 250 bbl. daily, natural, 1,247-61 ft.
J. C. Roberts 1 Sicking, 67 bbl. in 6 hr., pumping, natural, est. 150 bbl. daily, 1,293-1,326 ft.
J. C. Roberts 3 Sicking, 76 bbl. in 8 hr., pumping, natural, est. 150 bbl. daily, 1,262-96 ft.

Montague County

Benton & Holmes field: Ross Drilling Co. 1 H. C. Fields, 57 bbl. in 5 hr., ¼-in. choke, est. 175 bbl. daily, 3,838-51 ft.
Rogers & Rogers field: Phillips 1 Dodson, 74 bbl. in 3 hr., ½-in. choke, natural, est. 400 bbl. daily, 5,126-47 ft.
Ringgold field: Gulf 3 Worsham, 69 bbl. oil and 18 bbl. water daily, pumping, 1,500 gal. acid, 5,752-5,877 ft.

Throckmorton County

Wildcat: Humble 1 Durham, Sec. 1627, T.E.&L. Sur., top Caddo 4,182 ft., show oil 4,230-35 ft., dry at 4,428 ft.

Wichita County

Wichita field: Akin-Dimmock-Costley 3 Dodson, 5 bbl. daily, pumping, 5-qt. shot, 1,307-13 ft.
W. E. Production Co. 5 Glass, 110 bbl. daily, pumping, 1,305-22 ft.
K.M.A. field: Underwood Oil 2 Hieserman, dry at 1,376 ft.
C. O. Davis 2 Burnett, 67 bbl. in 3 hr., open tubing, est. 350 bbl. daily, 4,100-42 ft.
Bishop Oil 6 Waggoner A, 73 bbl. in 3 hr., ¾-in. choke, est. 325 bbl. daily, 110-qt. shot, 3,650-80 ft.
Shell 13 Preston A, 75 bbl. in 3 hr., open tubing, est. 325 bbl. daily, 150-qt. shot, 4,002-80 ft.
K.M.A. Deep field: Shell and Phillips 14 Preston, 72 bbl. in 3 hr., ¼-in. choke, est. 400 bbl. daily, top K.M.A. lime 3,826 ft., top Ellenburger 4,460 ft., pay 4,453-4,503 ft.

Wise County

Wildcat: Manahan Oil 1 Collier, J. M. Wade Sur., top Caddo 5,533 ft., dry at total depth 6,047 ft.

Young County

Wildcat: H. R. Loftin 1 Loftin, Ann Wood Sur., Abst. 1274, dry at 619 ft.
Olney field: Halbrook & Woods 1 Pigg, 5 bbl. daily, pumping, 593-604 ft.
G. J. School 1 Howard, dry at 954 ft.
W. F. Palmer 14 Campbell, dry at 1,072 ft.

NORTH TEXAS WILDCAT REPORT

Archer County

W. B. Hamilton 22 Cartwright, 660 ft. from W and S lines, James Webb Sur., Abst. 664, T.D. 5,211 ft., P.B. 5,164 ft., 60-qt. shot 5,149-61 ft., swabbing and cleaning out, est. 30 bbl. oil daily.
Walter Gant 1 Hunter, SE NW Sec. 7, Blk. 1, H.&T.C. Sur., top Ellenburger 5,370 ft., T.D. 5,391 ft., cemented back 5,120 ft., tested after 10-day shutin, made 40 bbl. oil first hr. and 19 bbl. second hr., then well went dead.
King Oil 1 Taylor, Lot 1, Sec. 13, A.T.N.C.L. Sur., top Ellenburger 4,963 ft., T.D. 5,055 ft., shot off pipe with 70-qt. shot from 4,927-44 ft., pumped 59 bbl. in 16 hr. and pumped off.
W. B. Hamilton 1 C. E. Graham, C SE part of Gibenrath Sur., Abst. 136, 2,000-ft. test, S.D. 1,975 ft., prepare to drill deeper.
Magnolia 1 Hayton, SE SE SE Sec. 2415, T.E.&L. Sur., 5,400-ft. test, drilling 4,457 ft.

Baylor County

Hattie B. Madden 2 J. J. James, Sec. 150, T.&N.O. Sur., show oil 1,352-63 ft., lost drill pipe 2,308 ft., S.D.

Rogers & Lanfair 1 Howe, J. Howe Sur., Abst. 572, show oil 1,445-52 ft., S.D. 3,115 ft., T.D., may drill deeper.

Baldwin & Reed 1 Robertson, 3,600 ft. from N and 630 ft. from E lines Robertson C.S.L. Sur., Abst. 280, drilling 3,035 ft.

Clay County

Bridwell Oil 1 W. H. Myers, C. Thompson Sur., Abst. 444, top Caddo 5,486 ft., drilling 5,590 ft.

Gulf 1 C. W. Scaling, NW NW Sec. 31, T.&N.O. Sur., Abst. 685, 6,000-ft. test, drilling 4,886 ft.

L. T. Burns 1 Southerland, NE cor. of 100 acres of Sec. 63, J. H. Belcher Sur., 5,500-ft. test, T.D. 5,386 ft.

L. W. Stanford 1-A Edrington, 8,689 ft. from S and 150 ft. from E lines of F. W. Grassmeyer Sur., Abst. 694, 1,200-ft. test, S.D. repair 700 ft.

George Graham 1 Hansard, 1,736 ft. from N and 914 ft. from W lines of lease in Thornberry subd., 1,250-ft. test, show oil 400-22 ft., installing pump to complete, T.D. 1,144 ft.

L. T. Burns 1 Fred Wines, 593 ft. from N and 476 ft. from E lines of Sec. 1, Halsell subd. No. 1, 5,500-ft. test, location.

George Graham 2 Hansard, 1,736 ft. from NW and 614 ft. from SW lines Sec. 8, Thornberry subd., 300 ft. SW of No. 1 well, 1,150-ft. test, 7-in. at 1,122 ft., T.D. 1,135 ft., show oil.

Cooke County

Texas Co. 1 Bindel, 1,530 ft. from N and 330 ft. from W lines of Francis Hughes Sur., Abst. 439, 3,000-ft. test, show oil 1,885-96 ft., preparing to test.

Hood County

Aztec Oil 1 Gallagher, SW SE Robert Alway Sur., 3,000-ft. test, S.D. orders 2,200 ft.

Jack County

Continental 1 Robertson, M. J. Swan Sur., Abst. 1659, top Ordovician 5,380 ft., T.D. 5,577 ft., P.B. 5,514 ft., swabbing est. 50 bbl. oil per 7 hr. but will not flow, still testing.

R. A. Conkling 1 M. Hoffle, A. James Sur., Abst. 318, 3 mi. S of Antelope, 3,500-ft. test, T.D. 3,128 ft., S.D., repair 3,165 ft.

K. N. Davis 1 Jones, NW cor. E½ Sec. 2555, T.E.&L. Sur., 1 mi. SE Perrin, 2,500-ft. test, moving in rig.

Harper-McClintock 1 Kinder, 1,400 ft. from E and 467 ft. from N lines, Sec. 2667, T.E.&L. Sur., 6⅝-in. casing 1,640 ft., T.D. 1,900 ft., underreaming casing at 1,860 ft.

O. J. Perrin 1 Brumbelow, 1,045 ft. from S and 720 ft. from E lines, H. C. Ayers Sur., Abst. 4, S.D. 3,505 ft. after electrical survey.

Continental 1 Johnson, N part of D. D. Burton Sur., Abst. 1671, 5,500-ft. test, coring 5,503 ft.

Reed & Craft 1 Richards, 467 ft. from W and 1,200 ft. from N lines of C. Gates Sur., Abst. 237, 3,500-ft. test, digging pits.

C. H. Peterson 1 Hoefle, SE cor. John W. Barrett Sur., Abst. 48, 500-ft. test, 8-in. at 228 ft., 7-in. at 325 ft., show oil 340-42 ft., 438-44 ft., T.D. 444 ft.

Adam Grafe 1 H. R. Bloodworth, 6,986 ft. from S and 3,244 ft. from N lines, William McDonald Sur., Abst. 380, 3,500-ft. test, moved in material and S.D.

Montague County

Seitz, Comegys & Seitz 1 Ritchey, NE cor. S½ Sec. 66, Belcher subd., 6,200-ft. test, first report.

Walter Gant 1 Will Laird, R. T. Millard Sur., Abst. 470, 7 mi. W of Sunset, T.D. 6,651 ft., P.B. to 6,596 ft., perf. casing 4,865-73 ft., best gage for 125 bbl., swabbing in 6 hr. after S.I. for 10 days, rotary moved off, may plug back again and test Strawn series oil shows.

T. F. Hunter and Wilcox O. & G. 1 Barcas, SE Sec. 78, Kaufman C.S.L. Sur., Abst. 407, T.D. 4,705 ft., cemented back to 4,383 ft.

Redman Brothers 1 Hardy, 225 ft. from N and E lines of 41-acre tract in Fielding Secrest Sur., Abst. 665, 2,500-ft. test, S.D. 2,360 ft., no shows.

Benson & Benson 1 Seay, SE SE SE Sec. 31, Blk. 4, H.&T.C. Sur., 4,000-ft. test, location.

Sinclair Prairie 1 Clingingsmith, 467 ft. from S and W lines of Sec. 149, Jose Olabarri Sur., Abst. 579, 6,000-ft. test, 9⅝-in. at 749 ft., drilling 1,970 ft.

Throckmorton County

Rathke Oil 1 Swagerty, 495 ft. from N and 746 ft. from E lines of SW Sec. 258, B.B.B.&C. Sur., 5,000-ft. cable-tool test, T.D. 1,765 ft., U.R. 10-in. casing to T.D.

Humble 1 Allie McKnight, 1,100 ft. from N and 600 ft. from E lines, Sec. 2, D.L.&C. Sur., Abst. 1264, 5,000-ft. test, top Caddo 4,021 ft., show oil 4,028-42 ft., T.D. 4,049 ft., drilled plug and testing through tubing.

Wichita County

R. H. Larsen 1 Karrenbrock, 675 ft. from N and 625 ft. from E lines of J. Aldredge Sur., Abst. 4, T.D. 620 ft., last report.

Wilbarger County

O. H. Hammer 1 A. V. Shelton, NW NW Sec. 16, Blk. 11, H.&T.C. Sur., 4,500-ft. test, first report.

W. H. Gant 1 Mock, Sec. 23, Blk. 11, H.&T.C. Sur., 6,000-ft. test, drilling 5,333 ft.

Ray Brothers 1 Henry Streit, 72-acre tract in S. N. Gosnel Sur., Abst. 1231, drilling up iron 2,058 ft.

S. S. Kouri and W. B. Omohundro 1 Kelly, 467 ft. from S and W lines of Sec. 54, Blk. 13, H.&T.C. Sur., 4,000-ft. test, 10-in. at 85 ft., drilling 1,657 ft.

Wise County

Manahan Oil 1 E. R. Collier, J. M. Wade Sur., Abst. 868, corrected depth 7,500 ft., prepare to drill ahead below 6,047 ft., repairing rig.

Young County

Ben H. Rankin 1 Mary Logan, SW part Blk. 2, J. W. Doty Sur., 8 mi. NE Graham, 2 mi. W Nelson field, tested 1,000,000 cu. ft. gas from 4,288-95 ft., top Marble Falls 4,470 ft., S.D. 4,475 ft.

Dorian & Farrell 1 Grigsby, Sec. 416, T.E.&L. Sur., 7-in. 3,972 ft., show oil 3,979-89 ft., bailed 1½ gal. oil per hr., T.D. 4,991 ft., P.B. 3,989 ft., 40-qt. shot, made 3 bbl. oil in 1½ hr., testing.

Frank Buttram 1 Holmes, 600 ft. from W and 1,960 ft. from S lines, J. M. McRodgers Sur., Abst. 1878, show gas 4,006-11 ft., T.D. 4,065 ft., treated 7,000 gal., acid, no results, P.B. 4,050 ft.

L. T. Burns 1 Larimore A, 500 ft. from N and W lines of E 200 acres of Sec. 150, T.E.&L. Sur., 5,200-ft. test, Rigging up rotary.

Mason & Hibbs 1 Leverman, SW SW Sec. 271, T.E.&L. Sur., S.D. repair 697 ft.

WEST CENTRAL TEXAS

FORT WORTH, Tex., Mar. 24.—Midway between the Stith and the Akard fields in southern Jones County the Harry Hines and Brockover 1 A. M. Wimberly, Section 87, De Witt County School Lands Survey, after developing small production from the Cook level, is being deepened in search of a more prolific horizon. After acid treatment in lime from 2,222-40 ft. the test made several good pumping gages. The 8-in. hole was carried to the top of the lime where casing was cemented.

Another operation has been started in the Nowles field of northern Jones and southern Haskell counties. Opened to production more than a year ago by a test which found saturation in the Palo Pinto lime but was later plugged as noncommercial, several failures have been drilled without greatly adding to the subsurface picture of the area. The newest operation is J. C. Hunter 1-B Hazel C. Strand, on an 80-acre farmout from the Carl B. King Drilling Co. The test is 1,000 ft. southeast of the same operator's 1 Strand, a small pumping well located 467 ft. from the north and east lines of W½ SE Section 5, H.&T.C. Survey, on the southwest end of the field.

Shallow Discovery

A new shallow discovery was recorded the past week in southern Shackelford County. Discovery is Hagerty & Grossenbacher 1 Elliott, SW Section 12, Lunatic Asylum Lands Survey. It rated a pumping gage of 30 bbl. daily from saturation in the Humble sand from 833-40 ft. Ungren & Frazier 1 Elliott is a south offset location to the discovery and located in NW cor. Section 19, L.A.L. Survey. A mile east of the discovery, R. H. Roark 1 Elliott is drilling below 635 ft. It is located 1,700 ft. from the south and 150 ft. from the east lines of Section 13, L.A.L. Survey. The new

(Continued on Page 240)

REFINERY EQUIPMENT

BUILT-TULSA TYPE RIGHT

FACILITIES
FOR ANY SIZE
OR TYPE EQUIPMENT

Tulsa Boiler & Machinery Co.

WEST TWENTY-FIRST STREET & UNION AVENUE — TULSA, OKLAHOMA

Northwest Pennsylvania Test Shows Oil in St. Peter

By STAFF CORRESPONDENT

NEWARK, Ohio, Mar. 24.—Ohio operations resulted in 31 new completions, 12 gas, 14 oil, and 5 dry; 2 drilled-deeper jobs netted small gassers. A Clinton test in eastern Tuscarawas County is a light gasser at 4,827 ft. Three gas wells were completed just north of the Newark corporation line in Licking County. Coshocton County test on the Cambridge arch was dry through the Gordon.

Ohio Oil Co. has reached the Trenton horizon in 8 J. H. Armstrong, Section 8, Wooster Township, Wayne County, top of Trenton was had at 5,005 ft., with a very light show of oil at 5,015-21 ft.; drilling ahead at 5,030 ft.

SUMMARY OF COMPLETIONS

Ohio

	No.	Bbl.	Footage
Oil	14	21	9,690
Gas	12	*6.5	32,150
Dry	5	.....	8,933
Total	31	.....	50,773
Recompletions	2	.....	.....
Input wells	1	.....	.....

*Million cu. ft.

Indiana

	No.	Bbl.	Footage
Oil wells	7	1,237	17,767
Dry holes	8	.....	12,629
Total	15	.....	30,396

Eastern Kentucky

	No.	Oil	Footage
Oil wells	1	50	1,112
Gas wells	6	*2.3	17,200
Total	7	.....	18,312

Western Kentucky

	No.		
Oil wells	1	15	1,283
Dry holes	2	.....	2,482
Total	3	.....	3,765
Recompletions	2	15	.....

*Million cu. ft.

NORTHWEST PENNSYLVANIA

Ohio 1 Jay Childs, in Springfield Township, Erie County, had a slight show of gas and oil in the St. Peter, found at a depth of about 5,190 ft. A slight amount of salt water was soon exhausted.

This is believed to be the first time the St. Peter has been found in Pennsylvania and also the farthest east location of that horizon.

Elevation of the well is 630 ft. The top of the Trenton lime was found at 4,437 ft.

It is not known whether the oil in the St. Peter is the same as the light green oil in the top of the Trenton.

OHIO FIELDS

Ashland County

Perry Township: Price et al 2 J. A. Finley, Sec. 17, 3 bbl., Berea, shot, T.D. 768 ft.

Athens County

Rome Township: Mathews Oil Co. 1 J. H. Marshall, Sec. 25, 40,000 cu. ft. gas, second Berea, shot, T.D. 1,486 ft.

Carthage Township: Ohio Fuel 2 E. W. Swisher, Sec. 16, 200,000 cu. ft. gas, Keener, T.D. 1,296 ft., drilled deeper from Salt sand at 1,054 ft.

Belmont County

Somerset Township: Spangler & McCort 1 James Butler, Sec. 31, 30,000 cu. ft. gas, Berea, T.D. 1,580 ft.

Fairfield County

Rush Creek Township: City Natural 1 Pearl Upp, Sec. 6, 190,000 cu. ft. gas, Clinton, T.D. 2,430 ft.

Coshocton County

Lafayette Township: Belmont Quadrangle Corp. 1 Charles Zimmer, Lot 8, fourth quarter, dry, Berea 839-78 ft., no Gordon sand found, T.D. 1,418 ft.

Holmes County

Knox Township: Lydic Oil Co. 2 Wallace Bell, Lot 12, 1 bbl., Berea, T.D. 963 ft.

Knox County

Butler Township: Upham Gas 2 Walter Busenberg, Lot 7, 700,000 cu. ft. gas, Clinton, T.D. 2,871 ft.

Union Township: Fisher et al 1 Gilbert Hammer, Danville corporation, 600,000 cu. ft. gas, Clinton, shot, T.D. 2,860 ft.

Licking County

Newark Township: Jay Hunt 1 C. W. Ritter, first quarter, 1,500,000 cu. ft. gas, Clinton, T.D. 2,406 ft.

Everett Co. 1 L. A. Mitchell, first quarter, 550,000 cu. ft. gas, Clinton, T.D. 2,386 ft.

A. Willey et al 1 Amy Samuelson, first quarter, 500,000 cu. ft. gas, Clinton, shot, T.D. 2,381 ft.

Mary Ann Township: H. C. Leightner 3 Robert Reidenour, fourth quarter, 6 bbl., Berea, shot, T.D. 750 ft.

Medina County

Chatham Township: Blizzard Oil Co. 1 B. E. Grim, Tr. 1, Lot 5, 5 bbl., Berea, T.D. 634 ft.

Preston Oil Co. 1 Richard M. Grim, Tr. 4, Lot 4, 5 bbl., Berea, T.D. 567 ft.

Marine Trust Co. 1-A William P. Wertz, Tr. 14, Lot 5, 5 bbl., Berea, T.D. 407 ft.

Marine Trust Co. 15-A William P. Wertz, input, Berea, T.D. 428 ft.

Marine Trust Co. 16-A William P. Wertz, 5 bbl., Berea, T.D. 434 ft.

Marine Trust Co. 21-A William P. Wertz, 5 bbl., Berea, T.D. 451 ft.

Marine Trust Co. 25-A William P. Wertz, 5 bbl., Berea, T.D. 448 ft.

Marine Trust Co. 26-A William P. Wertz, 5 bbl., Berea, T.D. 412 ft.

Marine Trust Co. 27-A William P. Wertz, 5 bbl., Berea, T.D. 434 ft.

Marine Trust Co. 28-A William P. Wertz, 5 bbl., Berea, T.D. 403 ft.

Spencer Township: Ohio Fuel 1 Ellsworth Breyley, Sec. 1, dry, Clinton, T.D. 2,716 ft.

Ohio Fuel 2 G. C. Heilman, Sec. 7, 100,000 cu. ft. gas, blew out, plugged, Clinton, T.D. 2,698 ft.

Meigs County

Sutton Township: Tyree 2 H. M. Capehart, Sec. 30, 30,000 cu. ft. gas, Ohio shales, shot, T.D. 3,347 ft., drilled deeper from Berea at 1,871 ft.

Monroe County

Summit Township: A. E. Robinson 1 A. L. Hogue, Sec. 5, dry, Keener, T.D. 1,400 ft.

Wayne Township: J. H. Weber 1 Matilda Frank, Sec. 27, 10 bbl., Maxon, T.D. 1,205 ft.

Muskingum County

Harrison Township: Mehowa O. & G. 1 Charles Olden, Sec. 11, 1,000,000 cu. ft. gas, Clinton, T.D. 4,050 ft.

Noble County

Jefferson Township: Permian Gas Co. 1 George Hesson, Sec. 5, 280,000 cu. ft. gas, Berea, T.D. 1,846 ft.

Tuscarawas County

Dover Township: Columbia Carbon Co. 1 Nathaniel Sieber, Lot 2, first quarter, 250,000 cu. ft. gas, Clinton, shot, T.D. 4,827 ft.

Washington County

Newport Township: Schneider Oil Co. 1 John Haynes, Sec. 27, 1 bbl., Salt sand, shot, T.D. 1,414 ft.

Wayne County

Plain Township: Ohio Fuel 1 Milton Shaffer, Sec. 32, 850,000 cu. ft. gas, Clinton, shot, T.D. 3,027 ft.

Sugar Creek Township: Peak & Nohe 1 J. I. Goudy, Sec. 14, dry, Berea, T.D. 701 ft.

INDIANA

EVANSVILLE, Ind., Mar. 24.—Developments in Indiana last week indicated the opening of a new pool from the Waltersburg sand in the area east of present production in the Griffin pool of Gibson County and the promise of a new producing horizon in the College field of Posey County.

On the east side of the Griffin field of Gibson County, Turbeville 1 Heston, NE NE SE 8-3s-13w, was waiting on cement after setting casing during the latter part of the week to test saturation in the Waltersburg sand at 2,001-21 ft. The well is located in an area which has been condemned by many operators due to dry holes which have been drilled on the west, east and south sides of the prospective pool opener.

In the College field of Point Township, Posey County, Bauman 1 Ritter, SW SW SE 9-8s-14w, was waiting on cement with casing set to the McClosky. The field's present producing horizon, the Aux Vases, showed only slight saturation and the well was deepened to the McClosky at 2,687-97 ft., where a 17-minute drill-stem test recovered 40 ft. of oil-cut mud and no water. The 1 Ritter is a half mile north of present production in the field.

Continental's latest Salem test in the Griffin pool, 6 Kleiderer, NW SE SW 26-3s-14w, proved unsuccessful last week and the well was plugged back to the McClosky. The 6 Kleiderer, like the two previous Salem lime tests in the field, encountered good saturation in the lime but found it too tight for commercial production.

INDIANA COMPLETIONS

Crawford County

Wildcat: J. C. Barnett 1 Baylor, SE SE SW 22-1s-2e, dry, show oil 1,150-55 ft. in Devonian, T.D. 1,351 ft.

Elkhart County

Wildcat: A. W. Downs 1 Harmon, NE NE SE 11-38n-4e dry, Traverse 614 ft., tested 10 bbl. oil and 150 bbl. water a day, now pumping all water, T.D. 650½ ft.

Gibson County

South Griffin pool: Continental 19 Keck, NW NW SW 27-3s-14w, pumped 10 bbl. an hour, 3,000 gal. acid, McClosky 2,851-94 ft., T.D. 2,896 ft.

Continental 31 Bozeman, SW SW NW 26-3s-14w, salt-water disposal well in McClosky.

Continental 29 Bozeman, SE SE NW 23-3s-14w, pumped 223 bbl., natural, Cypress 2,484 ft., T.D. 2,555 ft.

Griffin pool: Hall Edwards 19-A Maier, N½ NW SE 14-3s-14w, flowed 250 bbl., 35-qt. shot 2,503-25 ft., T.D. 2,528 ft., old completion not previously reported.

Hall Edwards 23-A Maier, NW SW NE 14-3s-14w, flowed 600 bbl. natural, T.D. 2,543 ft.

Lewis Prod. 15 Cooper-D, SW SE NW 13-3s-14w, flowed 214 bbl., 15-qt. shot 2,488-2,500 ft., Cypress 2,481 ft., T.D. 2,500 ft.

Papoose 8 Cooper-A, SE NW SW 13-3s-14w, pumped 60 bbl., 3,800 gal. acid and 500 gal. reacid, T.D. 2,865 ft.

Wildcat: Petroleum Exploration Co. 1 Coolidge, SW SE 17-1s-11w, dry, Menard 1,481 ft., Waltersburg 1,559 ft., Glen Dean 1,712 ft., Hardinsburg 1,740 ft., Golconda 1,801 ft., Barlow 1,897-1,912 ft., Benoist 1,936 ft., T.D. 1,984 ft.

Knox County

Wildcat: Hughes Pet. Co. 1 Met. Life, NW NW NE 11-1n-11w, dry, Barlow 1,664-72 ft., Benoist 1,836 ft., Renault 1,854 ft., Ste. Genevieve 1,868 ft., Fredonia 1,920 ft., T.D. 2,020 ft.

Posey County

Wildcat: Hollandsworth et al 1 Crumm, NW NW SW 5-4s-13w, dry, Renault 2,709 ft., Ste. Genevieve 2,824 ft., McClosky 2,884 ft., slight show oil, T.D. 2,955 ft.

Holemans 1 Mumford, SE NW NE 6-4s-13w, pumped 125 bbl., perf. 1,898-1,906 ft., T.D. 2,931 ft., P.B. 2,200 ft.

Sullivan County

Wildcat: Trio Drlg. 1 Eaton, NW NW 2-7n-9w, dry, sand 816-24 ft., H.F.W., T.D. 824 ft.

Dodds Bridge pool: W. J. Reynolds 1 Poe, NE NE SW 3-8n-10w, pumped 5 bbl. oil and 100 bbl. water, 600 gal. acid 1,455-77 ft., Salem 1,430 ft., T.D. 1,477 ft.

Vanderburg County

Heusler pool: Harvey Simms et al 1 Heil, NW NW SW 6-7s-11w, dry, H.F.W. 1,820-36 ft., T.D. 1,836 ft.

Wildcat: W. R. White 1 Herdink, NW NW SE 4-6s-10w, dry, H.F.W. 1,002-08 ft., T.D. 1,008 ft.

INDIANA DRILLING REPORT

Crawford County

Reece-Dietz et al 1 Esarey.....NE NW NE 36-3s-1w
Fishing 270 ft.

Gibson County

Joe Bander et al 1 Dunn.....SW SE SW 18-3s-13w
First report, rigging up rotary.

Turbegoille et al 1 Heston.....NE NE SE 8-3s-13w
Base Pennsylvanian 1,704 ft., Menard 1,909 ft., Waltersburg sand 1,986 ft., saturated sand 2,001-21 ft., 7-in. 1,968 ft., waiting on cement.

Hyslop et al 1 fee.....NW NE NW 20-1s-9w
S.D. 1,674 ft.

Greene County

Midwest et al 1 Good.....W½ NE NW 21-6n-7w
Spud.

Knox County

C. M. Lane et al 1 Morgan.....SW SE SW 32-2n-9w
Drilling 1,075 ft.

Naomi Oil 1 Walden.....NE NE NE 10-5n-10w
S.D. 791 ft.

Monroe County

Terry Deskins 1 Cowling.....SW SW NW 34-7n-1e
S.D. 515 ft.

Terry Deskins 1 Thompson.....NE NW SE 18-9n-1e
S.D. 776 ft.

Orange County

United States Oil 1 G. E. Willyard.....
NW NE SW 33-1n-1w
Drilling 570 ft.

Perry County

H. E. Pollock 1 J. F. Heck.....SE SE SE 16-7s-3w
S.D. 140 ft.

Pike County

G. W. Miller 1 Nixon.....SE SW NE 14-3s-8w
S.D. 4,560 ft.

Posey County

McCummings et al 1 Ritter.....SW SW SE 9-8s-14w
McClosky 2,687-97 ft., show free oil, 5½-in. 2,683 ft., waiting on cement.

Holemans et al 1 Oeth.....NE SE NE 6-4s-13w
T.D. 2,981 ft., P.B. 2,935 ft., now pumping 3 bbl. oil and 50 bbl. water a day.

(Continued on Page 232)

New Fields, Spacing Changes Promise Much Drilling

By
L. P. STOCKMAN

LOS ANGELES, Calif., Mar. 24.—Late last year it seemed for a time that operators might be forced to reduce drilling operations late this summer if aggressive development continued due to the fact that there would be very few favorable locations available in proved fields after 6 months' activity. Subsequent developments indicate the probability that drilling operations in California during 1941 will closely approximate development work last year. This change in future prospects reflects several subsequent developments of importance. Outstanding of these is the expectation that about 100 wells may be completed in the Inglewood field, increased drilling in the Newhall-Castaic region and a change in existing well-spacing programs. The latter is of prime importance because in most new fields discovered during the past several years wells are drilled on the basis of 1 well to each 20 acres. This program was adopted for economic reasons but some operators seriously question the advisability of conforming with this program because of the possibility that a development program along this line will increase the amount of unrecoverable oil beyond economic limits. Obviously where more wells are drilled the total recovery will be greater but this must be regulated within limitations established by the law of diminishing returns.

Shell Oil Co., Inc., is the first operator to deviate from the established program of 1 well to 20 acres and many operators share the belief that Shell officials are showing excellent judgment. Shell's deflection from the 1 to 20 program is in the Ten Section field of Kern County which the company discovered and where it has developed a substantial potential. It will be recalled that several months ago, Shell Oil Co., Inc., began drilling slim holes at Ten Section with excellent results from a development standpoint and at very low cost. The latter factor is an important one and has resulted partially from the use of 4½-in. tubing as drill pipe during drilling operations and finally as a combination oil string. These slim holes have reduced drilling time to an average of around 25 days or better to depths approximating 8,225 ft. at Ten Section and the cost of drilling slim holes by Shell's method probably does not exceed 60 per cent of the cost of drilling a normal size hole and finishing in the conventional manner with larger diameter casing, larger section opposite the oil sand and larger string of tubing.

At the close of last year, one could not see much more than 250 undrilled locations in the Northeast Coalinga, Southeast Coalinga, Ten Section, Greeley, Rio Bravo, Tupman, Coles Levee, Strand, Canal and Wilmington fields on the basis of the then-existing program of 1 well to 20 acres. If the movement develops to drill 1 well to 10 acres, and every indication points in this direction with the exception of Wasco and similar other deep fields, the 250 undrilled locations are stepped up to about 750 favorable and proved locations. The existing uniform method of allocation, the basis for curtailment in California, places a penalty on operators who do not continue drilling. As long as this penalty exists, California operators holding potentially productive acreage must continue drilling in order to maintain their pro rata share of allocated production. For this reason, it is logical to assume that operators will continue drilling and some of this development work will be in proved fields where the development program is based on 1 well to each 20 acres.

SUMMARY OF COMPLETIONS

	No.	Bbl.	Footage
Oil wells: San Joaquin Valley	11	13,301	96,072
Los Angeles Basin	7	3,020	32,515
Dry holes	2	.....	9,699
Total	20	16,321	138,286

AVERAGE DAILY PRODUCTION

LEADING CALIFORNIA FIELDS

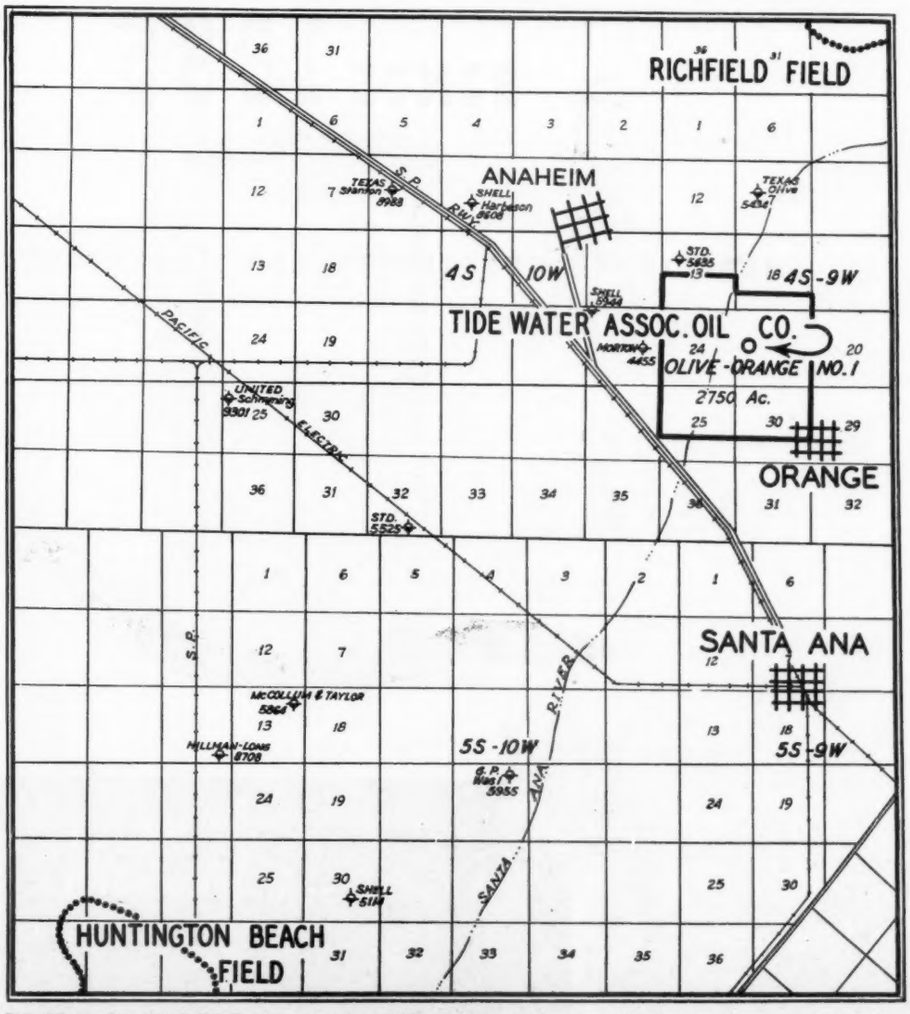
	Mar. 22	Mar. 15
Wilmington	81,750	82,725
Kettleman North Dome	43,050	39,650
Long Beach	42,160	42,220
Midway-Sunset	41,725	54,560
Coalinga	35,550	34,950
Ventura Avenue	33,825	34,075
Huntington Beach	27,425	27,430
Santa Fe Springs	23,875	23,890
Dominguez	21,425	21,025
Santa Maria Valley	19,725	19,240

SAN JOAQUIN VALLEY

In the Cantua district of Fresno County where operators have been attempting to find a new commercial accumulation consistently since 1931, it would appear necessary for Texas Co. to drill another well before it can estimate the value of its leases. The company's 27-13 Southern Pacific in 13-17s-23e does not look any too promising at 9,600 ft. although it showed up better than the initial well which is flowing 15 bbl. of 53-gravity oil and 180,000 cu. ft. of gas daily at the present time. A formation test made on 27-13 Southern Pacific at 9,370-9,455 ft. failed to show much and proved to be a distinct disappointment. This test recovered 35 stands of gas-cut mud and five stands of fresh to salty water with no free oil in evidence. The 70 ft. of oil sand cored in the interval tested looked good while drilling operations were under way but failed to show up as expected. The upper portion was very tight and the lower part of the interval only showed fair to poor porosity and permeability. It is the present intention to drill ahead to about 10,000 ft. before making any further tests.

Union Avenue.—Hancock Oil Co. has suspended work on 2 Union Avenue in the recently discovered Union Avenue field south of Bakersfield in Kern County at 5,602 ft. because it failed to correlate with the log of the discovery well. It is the belief that the company's second well in this heavy-oil field is located east of the Union Avenue fault which is expected to limit the productive area to that section to the west. Just how far north and south the productive limits will extend is problematical and must be determined by actual drilling. Hancock's third well in the Union Avenue field has been staked one location south of the discovery well. The company has not yet decided to abandon its second well but is expected to do so in the near future.

Paloma.—Western Gulf Oil Co. extended the pro-



Tide Water Associated Oil Co. has started a wildcat between Orange and Anaheim in Orange County, California. Several dry holes have been drilled in this district but none are close enough to affect this block of acreage

ductive limits of the Paloma field of Kern County a little over 1 mile southeast this week by completing 12-12-B Kern County Land in 12-32s-26e flowing 800 bbl. of 53.5-gravity condensate and 4,000,000 cu. ft. of gas daily from 10,752 ft. The initial daily production of this well does not represent its maximum potential as the company did not allow it to produce to capacity. It has more oil sand than other previous completions in the field and should therefore be as good as any other well in the field. A survey has been under way for several weeks to determine the most efficient method of operation of this distillate field.

SAN JOAQUIN VALLEY COMPLETIONS

Belridge North Field

Belridge Oil Co. 51-35 fee 35-27s-20e
Flowed 352 bbl., 41.6-gravity, 5 per cent cut, 17,500,000 cu. ft. gas. Two 96/64-in. beans. Pressures 280/1,300 lb. Elev. 667 ft. T.D. 8,482 ft. 9-in. water string 7,993 ft. 508 ft. 4¾-in. liner 8,482 ft. 250-mesh perf. 8,073-8,482 ft. 8,449 ft. 2½-in. tubing. Completed in Wagonwheel zone of Eocene age. 58 days' drilling time. Kern County.

Belridge Oil Co. 48-35-A fee 35-27s-20e
Flowed 244 bbl., 49.9-gravity, 7 per cent cut, 26,700,000 cu. ft. gas. Two 30/64-in. beans. Pressures 650/1,475 lb. Elev. 633 ft. T.D. 8,194 ft. 9-in. water string 7,806 ft. 406 ft. 4¾-in. liner 8,194 ft. 250-mesh perf. 7,820-8,194 ft. 8,149 ft. 2½-in. tubing. Completed in Wagonwheel zone of Eocene age 7,825-8,170 ft. Bottomed in shale. Temblor 5,042 ft. Redrilled and deepened from Temblor to Wagonwheel. Kern County.

Canal Field

Ohio 4-E Kern County Land 13-30s-25e
Flowed 1,296 bbl., 36.9-gravity, 1.2 per cent cut, 1,457,000 cu. ft. gas. 40/64-in. bean. Pressures 250/1,275 lb. Elev. 328 ft. T.D. 8,330 ft. 7-in. water string 8,080 ft. 273 ft. 4¾-in. liner 8,328 ft. 100-mesh perf. 8,078-8,328 ft. 8,312 ft. 2-in. and 2½-in. tubing. Recompleted after being deepened from 8,177 ft. to 8,330 ft. Completed in second interval of Stevens oil zone. Bottomed in Stevens oil sand of Miocene age. Kern County.

Coalinga Northeast Field

Amerada 37-17 S.P.L. 17-19s-16e
Abandoned at 8,453 ft. Elev. 525 ft. 5½-in. casing cemented 8,339 ft. and perf. 8,130-32 ft., 8,206-09 ft., 8,239-43 ft., 8,253-55 ft., 8,270-72 ft. Entire interval tested wet. Kreyenhagen 7,209 ft., green sand 8,161 ft., Gatchell sand 8,200-73 ft. Gray sand 8,273-78 ft. Fresno County.

Standard 88-7-B fee 7-19s-16e
Flowed 2,544 bbl., 27.2-gravity, 0.8 per cent cut, 1,325,000 cu. ft. gas. 36/64-in. bean. Pressures 830/1,065 lb. Elev. 552 ft. T.D. 8,200 ft. 7-in. water string 8,128 ft. 100 ft. 4¾-in. liner 8,197 ft. 60-mesh perf. 8,129-97 ft. 8,168 ft. 2½-in. tubing. Kreyenhagen 7,065 ft., green sand 8,047 ft. Gatchell oil sand 8,130-8,200 ft. 60 days' drilling time. Fresno County.

Coles Levee Field

Richfield 52-4-B Kern County Land 4-31s-25e
Flowed 334 bbl., 38.4-gravity, 30 per cent cut, 2,000,000 cu. ft. gas. Two 1½-in. beans. Pressures 150/625 lb. Elev. 307 ft. T.D. 9,750 ft. 8⅝-in. water string 9,195 ft. 581 ft. 6⅝-in. liner 9,745 ft. Perf. 9,208-9,328 ft., 9,328-9,454 ft., 9,483-9,548 ft., 9,601-9,745 ft. 9,705 ft. 2½-in. tubing. N point 8,873 ft. Stevens oil sand 9,240-9,750 ft. 54 days' drilling time. Kern County.

Kettleman North Dome Field

Kenda 72-32-J 32-21s-17e
Flowed 338 bbl., 47.9-gravity, 0.6 per cent cut, 15,900,000 cu. ft. gas. 38/64-in. bean. Elev. 975 ft. T.D. 10,690 ft. 6⅝-in. water string 10,003 ft. 688 ft. 4¾-in. liner 10,688 ft. Perf. 10,137-10,688 ft. 9,517 ft. 2½-in. tubing. Temblor 6,930 ft., brown shale 5,605 ft. Completed in Avenal zone of Eocene age. 122 days' drilling time. Fresno County.

McKittrick Field

Hoyt, Otis 2 Union 6-30s-22e
Pumped 150 bbl., 17.1-gravity, 3 per cent cut. Elev. 838 ft. T.D. 2,298 ft. 8⅝-in. water string 2,180 ft. 145 ft. 6⅝-in. liner 2,298 ft. Perf. 2,178-2,298 ft. 2,252 ft. 2½-in. tubing. Oil sand 2,191-2,298 ft. When completed, well began flowing but did not hold up. Present pumping practice is to agitate well after which it flows for 15 to 20 minutes. 41 days' drilling time. Kern County.

Paloma Field

Western Gulf 12-12 Kern County Land ... 12-32s-26e
Flowed 800 bbl., 53.5-gravity, 0.2 per cent cut, 4,000,000 cu. ft. gas. 28/64-in. bean. Pressures 2,000/2,500 lb. Elev. 288 ft. T.D. 10,752 ft. 7⅝-in. water string 10,230 ft. Perf. 10,230-10,752 ft. 10,250 ft. 2½-in. tubing. Extends productive limits 1 mile southeast. Kern County.

Pyramid Hills Field

C. M. O. Co. 1 Bocqueraz 17-24s-18e
Abandoned at 1,246 ft. Elev. 718 ft. Showed salt water. Point of Rocks sand 765-825 ft. Cretaceous 1,181-1,246 ft. Kings County.

Rio Bravo Field

Superior 4 Burner 27-28s-25e
Flowed 1,430 bbl., 38.3-gravity, 0.4 per cent cut, 1,797,000 cu. ft. gas. 32/64-in. bean. Pressures 1,510/1,600 lb. Elev. 340 ft. T.D. 11,470 ft. 7⅝-in. water string 11,284 ft. 208 ft. 5¾-in. liner 11,466 ft. Perf. 11,278-11,466 ft. 11,011 ft. 2½-in. tubing. Completed in Rio Bravo and Vedder zones of Miocene age. Rio Bravo 1,284 ft. Vedder 11,365 ft. Bottomed in oil sand. 43 days' drilling time. Kern County.

Strand Field

Associated 25-7-E Kern County Land 7-30s-26e
Flowed 1,135 bbl., 34.8-gravity, 19 per cent cut, 200,000 cu. ft. gas. 24/64-in. bean. Elev. 334 ft. T.D. 12,818 ft., P.B. 8,750 ft. 9⅝-in. water string 8,885 ft. Perf. 8,710-25 with 30 holes. When Vedder zone found barren hole plugged back and 9⅝-in. casing perf. opposite Stevens oil sand. Flowing through tester. Kern County.

Ten Section Field

Shell 47-29-A Kern County Land 29-30s-26e
Flowed 2,333 bbl., 34.1-gravity, 0.5 per cent cut, 1,975,000 cu. ft. gas. 14/64-in. bean. Pressures 950/1,575 lb. Elev. 331 ft. T.D. 8,235 ft. 4½-in. combination string 8,231 ft. Perf. 7,990-8,120 ft., 8,155-8,231 ft. 8,040 ft. 2-in. tubing. Completed in Stevens oil sand of Miocene age. 34 days' drilling time. Stevens oil sand 7,810-8,235 ft. Kern County.

Shell 63-29-A Kern County Land 29-30s-26e
Flowed 2,212 bbl., 33.6-gravity, 1.5 per cent cut, 1,826,000 cu. ft. gas. 128/64-in. bean. Pressures 275/950 lb. Elev. 334 ft. T.D. 8,235 ft. 4½-in. combination string 8,231 ft. Perf. 8,077-8,140 ft., 8,155-8,231 ft. 8,065 ft. 2-in. tubing. N point 7,530 ft. Completed in Stevens oil sand 7,820-8,235 ft. 25 days' drilling time. Kern County.

Shell 87-30-A Kern County Land 30-30s-26e
Flowed 1,673 bbl., 35.5-gravity, 0.3 per cent cut, 4,038,000 cu. ft. gas. 128/64-in. bean. Pressures 750/800 lb. Elev. 328 ft. T.D. 8,210 ft. 4¾-in. combination string 8,206 ft. Perf. 7,995-8,050 ft., 9,065-8,206 ft. 8,050 ft. 2-in. tubing. 24 days' drilling time. Kern County.

SAN JOAQUIN VALLEY OUTPOSTS

Coles Levee Field

Standard 20-8 Kern County Land 5-31s-25e
T.D. 9,600 ft. in gray sand. P.B. 9,530 ft. Swab salt water with trace of oil. Elev. 430 ft. Kern County.

Standard 20-9 Kern County Land 9-31s-25e
Rigged up. Elev. 304 ft. Kern County.

Elk Hills Field

Standard 42-31-S 31-30s-24e
Drilling and coring in sand and shale 6,840 ft. Elev. 1,122 ft. Kern County.

Standard 44-29-S 29-30s-24e
T.D. 3,900 ft., P.B. 3,230 ft. Making production test. Elev. 866 ft. Kern County.

Kettleman North Dome Field

Standard 1-1-U fee 1-23s-16e
Drilling in gray sand 11,395 ft. Formation test with packer 10,762 ft., light blow gas with water. Bottomed in Eocene. Elev. 693 ft. Kings County.

Midway-Sunset Field

No. Amer. Oil Consd. 1-28 W.P. 28-32s-23e
Drilling 6,296 ft. in very hard shale with streaks of impervious sand. Elev. 1,560 ft. Kern County.

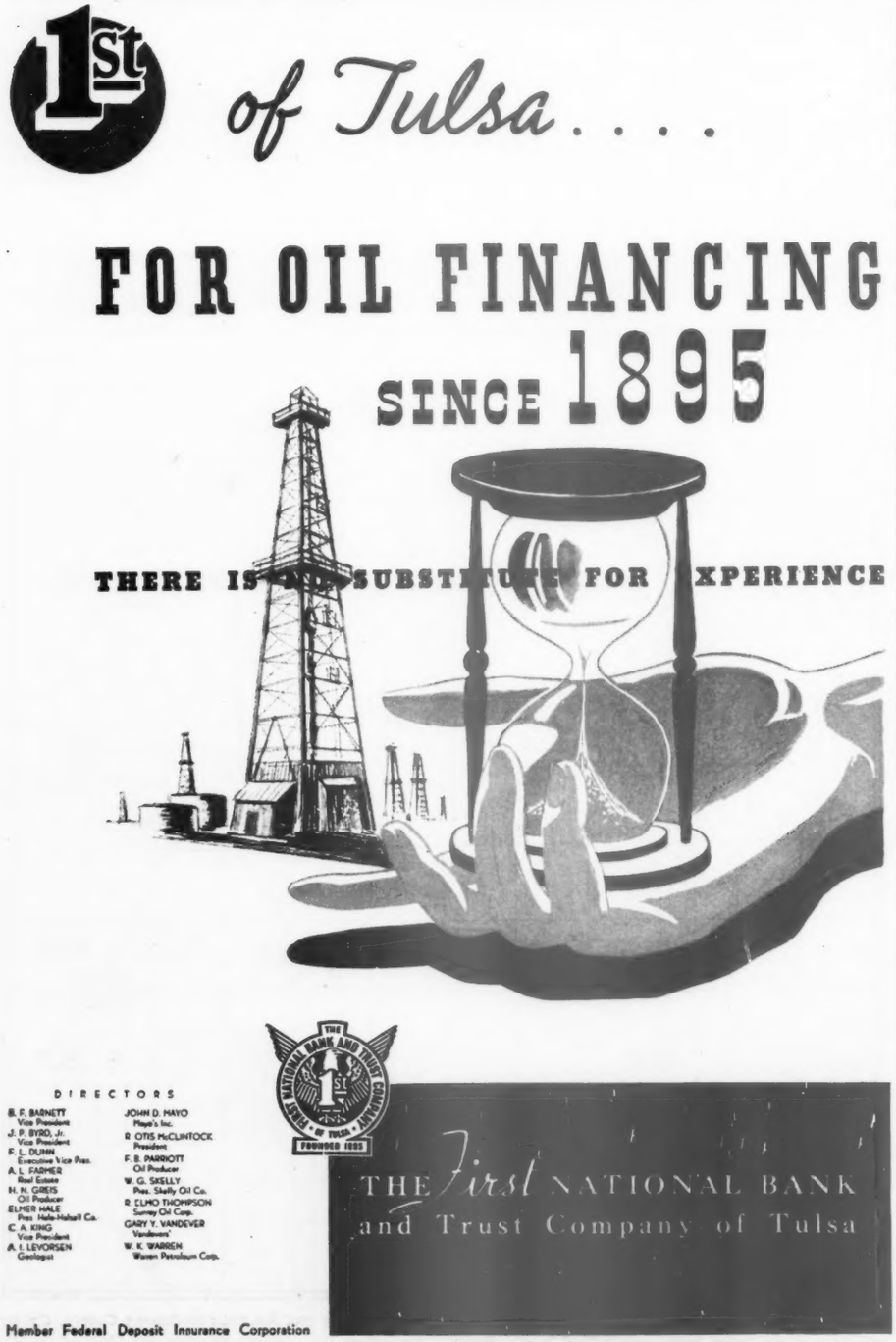
SAN JOAQUIN VALLEY WILDCATS

Cantua Creek District

Texas 27-13 Southern Pacific 13-17s-15e
Drilling and coring 9,580 ft. in sand and shale. Formation test of 56 ft. of oil sand 9,480-9,536 ft. inconclusive. Ground elev. 340 ft. Fresno County.

Buena Vista Hills District

Honolulu 25-P fee 10-32s-24e
Drilling 12,730 ft. in shale with streaks of hard



sand. Objective is Rio Bravo and Vedder zones. Elev. 916 ft. Kern County.

Buttonwillow District

Texas 47-15 Southern Pacific 15-29s-24e
T.D. 7,956 ft. in sand and shale. Redrilling 7,894 ft. Hole caving. Elev. 287 ft. Kern County.

Bellevue District

Ohio Oil Co. 1-G Kern County Land 36-29s-26e
Rigging up. Location 2,310 ft. S, 1,640 ft. E from NW cor. 36-29s-26e. Kern County.
Union 31-3 Kern County Land 3-30s-26e
Drilling 7,486 ft. in sand and shale. Kern County.

Lost Hills District

Associated 46-16 fee 16-27s-21e
Building road. Location 1,640 ft. N, 2,310 ft. E from SW cor. 16-27s-21e. Kern County.

Maricopa District

Bankline Oil Co. 24-24 Sunset 24-11n-23e
Drilling and coring in sand and shale 2,675 ft. Elev. 970 ft. Kern County.

Mount Poso District

Shell 77-11 Smith 11-26s-27e
Preparing to spud. Located 5 miles NW of Mt. Poso field. Expect production in Vedder zone around 3,000 ft. Kern County.

Shafter District

Continental 2-C Kern County Land 35-27s-24e
Drilling in sandy shale 11,349 ft. Fishing drill pipe. Elev. 986 ft. Kern County.

Tejon District

Richfield 1 Tejon ranch 2-10n-19w
Drilling and coring in gray Eocene sand and shale 10,940 ft. Elev. 1,043 ft. Kern County.
Kern Line Oil Co. 1 Wheeler Ridge 19-11n-19w
T.D. 8,435 ft. Derrick blew down with drill pipe in hole. Elev. 970 ft. Kern County.

LOS ANGELES BASIN

Drilling operations in the Wilmington field of Los Angeles County have settled down to a steady rate and should continue unchanged for another several months unless operators decide to proceed with deep exploitation of the Ford zone which has been held in its virgin state in the Long Beach Harbor section of the field. General Petroleum Corp. has killed 11 Terminal in the west side of the field and west of the Ford assembly plant and will deepen it to the Ford zone. The Wilmington field is blocked off by several north-south faults into four segments and drilling to date has indicated that there is no migration of oil or gas from one block to another. Because of this operators in the east or Long Beach Harbor section of the field have been able to keep the Ford zone in its virgin state despite the fact that several wells in blocks to the west have been carried down into the Ford zone. Union Pacific Railroad Co. which has acreage spreading across several blocks has finished several fairly good wells in the Ford zone in the west end of the field. The Ford zone west of the eastern block has not been found very productive but operators holding acreage in the east end of the structure expect to find the Ford zone exceptionally prolific. For this reason deep-zone exploitation has been held back for several years. There has been a considerable amount of reconditioning work done in the Wilmington field during the past year most of which consists of gravel-packing operations. This has proved exceptionally successful and many operators claim that gravel packing has kept out a large part of the fine sand that accompanies production from the Ranger and Terminal zones. This has, therefore, greatly enabled operators to keep wells on production longer and thus has indirectly enabled the field to maintain its high rate of production.

Torrance.—Recent completion of several wells in the area between the Torrance and Wilmington fields has greatly increased interest in the production possibilities of this area and recent developments indicate the probability that several new wells will be drilled within the next few weeks. Acoma Oil Co. which completed its well No. 1 this week pumping 150 bbl. daily of 21.1-gravity oil from 3,762 ft. has location staked for a second well. Production in this area is from the equivalent of the Ranger zone that is productive throughout the Wilmington field. There does not appear much chance for the present of operators extending the western limits of production in the Wilmington field north of Anaheim Boulevard as several permits were recently denied because a survey indicated that property owners in the general area were opposed to the opening up of any additional acreage to drilling. It is now conceded that the Ranger zone found originally in the Wilmington field undoubtedly extends as far as the southeastern limits of the Torrance field.

LOS ANGELES BASIN COMPLETIONS

Huntington Beach Field

Signal 2-A Bolsa 34-5s-11w
Pumped 240 bbl., 28.9-gravity, 8 per cent cut. Elev. 14 ft. T.D. 4,915 ft. P.B. 4,720 ft. 8⅝-in. water string 4,440 ft. 299 ft. 6⅝-in. liner 4,713 ft. Perf. 4,439-4,713 ft. 4,664 ft. 2½-in. tubing. Completed in Bolsa zone. 25 days' drilling time. Orange County.
Southwest Expl. Co. 36 State 4-6s-11w
Pumped 1,722 bbl., 23.6-gravity, 0.1 per cent cut. Elev. 49 ft. T.D. 5,141 ft. 8⅝-in. water string 4,420 ft. 728 ft. 6⅝-in. liner 5,139 ft. Perf. 4,417-5,139 ft. 4,367 ft. 2½-in. tubing. Completed in Huntington tideland by whipstocking well beneath Pacific Ocean by directional drilling. 26 days' drilling time. Orange County.

Montebello Extension Field

Kern Oil Co. 44 Monterey 2-2s-12w
Flowed 271 bbl., 36.6-gravity, 5 per cent cut, 1,423,000 cu. ft. gas. 38/64-in. bean. Pressures 200/450 lb. Elev. 331 ft. T.D. 7,755 ft. 7-in. combination string 7,563 ft. Perf. in 7-in. 7,090-7,280 ft., 7,300-80 ft., 7,400-7,535 ft. 7,414 ft. 2½-in. tubing. Completed in seventh and eighth zones. 44 days' drilling time. Los Angeles County.

Potrero Field

Basin Oil Co. 12 Potrero 34-2s-14w
Flowed compressor 350 bbl., 32.5-gravity, 2.7 per cent cut, 200,000 cu. ft. gas. 18/64-in. bean. Pressures 300/500 lb. Elev. 156 ft. T.D. 3,682 ft. 8⅝-in. combination string 3,682 ft. Gun perf. at intervals. 3,250 ft. 2½-in. tubing. Completed in first zone. 19 days' drilling time. Los Angeles County.

Torrance Field

Acoma Oil Co. 1 Torrance 30-4s-13w
Pumped 150 bbl., 21.1-gravity, 5 per cent cut. Elev. 28 ft. T.D. 3,762 ft. 6⅝-in. combination string 3,762 ft. Gravel-packed perf. 3,550-3,762 ft. 3,742 ft. 2½-in. tubing, packer 3,545 ft. Completed in equivalent of Ranger zone at Wilmington. 31 days' drilling time. Los Angeles County.

Wilmington Field

Dunlap, D. D. 2-W Harbor 33-4s-13w
Pumped 270 bbl., 14.3-gravity, 5 per cent cut. Elev. 18 ft. T.D. 3,615 ft. Redrilled to 3,565 ft. 10¾-in. water string 2,620 ft. 975 ft. 6⅝-in. gravel-packed liner 3,564 ft. 7-in. flow string 2,589 ft. Perf. 2,620-2,822 ft., 2,877-3,076 ft., 3,211-3,564 ft. 3,535 ft. 2½-in. tubing. Recompleted in Ranger zone after hole redrilled to 3,565 ft. Los Angeles County.
L. B. Dev. Co. 26-W Harbor 10-5s-13w
Flowed 222 bbl. Elev. 13 ft. T.D. 3,997 ft., P.B. 3,945 ft. 11¾-in. water string 2,525 ft. 8⅝-in. flow string 3,940 ft. 5½-in. flow string 3,305 ft. with packer 2,822 ft. Perf. 2,519-2,814 ft., 3,074-3,305 ft., 3,548-3,640 ft., 3,750-3,940 ft. 3,884 ft. 2½-in. tubing with packer 3,317 ft. Multiple zone completion. Ranger zone flow 100 bbl., 17.6-gravity, 5 per cent cut, 21/64-in. bean. Lower Terminal zone flow 122 bbl., 26.7-gravity, 6 per cent cut, 21/64-in. bean. Upper Terminal zone not produced. 45 days' drilling time. Los Angeles County.
Louden, A. J. 4 Harbor 35-4s-13w
Pumped 65 bbl., 15.1-gravity, 2.8 per cent cut. Elev. 12 ft. T.D. 3,510 ft. 8⅝-in. water string 2,262 ft. 1,350 ft. 6⅝-in. gravel-packed liner 3,510 ft. Perf. 3,200-3,510 ft. 3,350 ft. 2½-in. tubing. Completed in Ranger zone. 33 days' drilling time. Los Angeles County.

LOS ANGELES BASIN OUTPOSTS OR DEEP TESTS

Dominguez Field

Union 79 Callender 32-3s-13w
T.D. 12,720 ft. in basement schist. P.B. 12,464 ft. Fish tubing. Los Angeles County.

Inglewood Field

Standard 3-1 L. A. I. 17-2s-14w
T.D. 9,570 ft. Milling on iron. Formation Miocene shale and gray sand. Los Angeles County.
R. R. Bush Oil Co. 1 Merchants 8-2s-14w
Derrick built and early spud scheduled. Los Angeles County.

Rosecrans Field

Southern Cal. Pet. Corp. 1 Townsite 12-3s-14w
Drilling and coring in hard shale 7,996 ft., T. P. Pike Drilling Co. doing actual drilling. Los Angeles County.

LOS ANGELES BASIN WILDCATS

Dominguez-Gardena District

Wood-Mellon 1 Wood 31-3s-13w
T.D. 7,795 ft. P.B. 2,400 ft. Redrilled to 6,975 ft. Bailing and cleaning out. Los Angeles County.
Hiles Drilling Co. 1 Grant 29-3s-13w
Pongratz Pet. Co. drilled to T.D. 7,666 ft. and abandoned in 1940. Test wet. Recemented 6⅝-in. 7,200 ft. Cleaned out to 7,306 ft. Testing recement job. Los Angeles County.

Orange District

Associated 1 Olive-Orange 19-4s-9w
Preparing to spud. Elev. 175 ft. Orange County.

Whittier District

H. & C. Olive Co. 1 Joyce 22-2s-11w
Drilling sand and shale 4,102 ft. Orange County.

COASTAL DISTRICT

Drilling activity is expected to show a substantial gain in the Coastal district within another few weeks as most of the winter period is now past and operators will not have to cope with washed-out roads and flood conditions from heavy rain. A number of new operators have already started work in the Newhall-Castaic region and recent changes in ownership of leases indicate a further gain in work may be expected. Barnsdall has already resumed work on its jail farm property acquired from the Los Angeles County Board of Supervisors a short time ago and should be ready to begin making hole within another

(Continued on Page 237)

THIS photograph shows 8 of 21 units sold to one company, of the many installations of Leach Case Overhead Vapor Heat Exchangers for Houdry Catalytic Cracking Process.
Information about these and other types of heat exchangers and condensers sent upon request.
Fracto Control
TRADE MARK REG.
C.H. LEACH CO. Inc.
117 LIBERTY ST., NEW YORK, N.Y.

Halls Bayou Wildcat Ready For a Second Test

By
NEIL WILLIAMS

HOUSTON, Tex., Mar. 24.—Interest in the Texas Gulf Coast district has again shifted to the Halls Bayou area, Brazoria County, where preparations were being made to test Strake 1 Griffith, a wildcat located approximately 3½ miles from the Alta Loma field in the H. P. Cayce Survey. This well showed for a gas-distillate producer several weeks ago when tested at 10,325-33 ft., the total depth, but due to mechanical trouble as the result of excessive gas pressures, the flowing life of the well was short lived. The hole was plugged back, sidetracked and redrilled to a total depth of 10,410 ft., and casing was cemented for a production test following an electrical survey, which showed a broken sand and shale section with probable production at intervals from 10,294-10,410 ft. In a core from 10,393-10,410 ft., 12 ft. was recovered of which the top 6 ft. was firm sand with an oil odor while the bottom 6 ft. was sand with a slight oil odor and salty taste. Cores at 10,324-29 ft., and 10,320-40 ft. were logged as sand and shale carrying gas and distillate.

SUMMARY OF COMPLETIONS

	No.	Bbl.	Footage
Oil wells: Fields	11	1,559	70,876
Gas: Fields	3	.....	16,939
Dry holes: Fields	3	.....	22,320
Wildcats	2	.....	15,528
Total	19	.....	125,663

Chocolate Bayou.—Phillips Petroleum Co.'s attempt to extend production in the Chocolate Bayou field, Brazoria County, failed when a 12-minute drill-stem test through perforated liner at 11,560-70 ft. tested 500 lb. working pressure and recovered 6,300 ft. of salt water. At the close of the week the perforations had been squeezed off and the well was being tested at 11,534-11,630 ft. The well is located in the H.T.&B. Survey, and if successfully completed will mark up a mile east extension to the field.

Double Gum.—Prospects of opening production in the Double Gum area, Liberty County, were not bright as George Echols 2 Boyt tested 61 thribbles of salt water on a 1-hour drill-stem test through perforated casing at 8,606-13 ft. Total depth is 8,757 ft., and 5½-in. casing was cemented following an electrical survey which showed possible production in two sand sections from 8,570-80 ft., and 8,605-11 ft. Another test is expected to be made. With the abandonment of Dishman & Lucas 1 Robertson in the Tanner Bayou area, wildcat interest in the county is now centered on Charles G. Hooks 1 Lockin, a projected Wilcox test located northeast of Hightower which is drilling in shale below 7,000 ft.

Silsbee.—Approximately 1½ miles southwest of the Silsbee field, Hardin County, Republic Production Co. 1 Elliott is drilling in a sidetracked hole below 3,100 ft. after plugging back from a total depth of 7,049 ft. Apparently the company intends to recore the Cockfield sand at 6,850-63 ft. where a drill-stem test the previous week showed promise of production.

Offshore Test

Offshore from Jefferson County in the Gulf of Mexico, British American 2-71 State is scheduled to be tested after a 9⅝-in. casing was cemented at 5,091 ft. Total depth of the hole is 6,721 ft. Several sands are reported to have been logged by an electrical survey, and a test of these sands is expected before the hole is drilled deeper.

Sheldon area.—O. J. McCullough 1 W. S. Swilley, a wildcat located in the Sheldon area, Harris County, is being watched with considerable interest as it approaches the expected Frio sand horizon. Sand was drilled from 3,193-3,207 ft., while sand with a possible gas show was logged at 3,672-85 ft. Sand was cored at 3,925-41 ft., but no recovery was made and the well is drilling in sandy shale below 3,961 ft. This well is on strike with the Dyersdale field located about 4 miles due west, the discovery of which has created widespread interest in this particular sector. The latter field is producing low-gravity crude from the Frio sand at approximately 4,000 ft. The outcome of the McCullough test should be known by the middle of the week.

La Ward.—The newly opened La Ward field, Jackson County, continues to loom as an important crude reserve as the limits of the field were extended several hundred feet to the southeast with the completion of Humble 1 Strauss. With the hole bottomed at 5,225 ft. and 5½-in. casing cemented at 5,215 ft., The well flowed at the rate of 22 bbl. of oil per hour through a ¼-in. choke. The company is moving the rig to 1 Louis Bonnett, another outpost located several hundred feet to the southwest.

Montgomery County Wilcox Test

Ralph Sturm and Morris Womack are preparing to deepen 2 Foster estate, an abandoned Wilcox test located in the Willis area, Montgomery County. The well will be deepened from its present depth of 7,265 ft. to a depth of 7,800 ft. The recent opening of the Lake Creek area in the same county which is producing from the Wilcox at a depth of 9,200 ft., and the opening of a new productive sand in the Sheridan field, Colorado County, by Shell Oil Co., Inc., at a depth of 9,300 ft. has thrown additional light on the potentialities of the Wilcox trend. These two wells were completed for producers after drilling more than 1,000 ft. into the Wilcox formation, and many tests which were abandoned after drilling only a few hundred feet into the formation can now be expected to be deepened.

Location for another wildcat was announced for the Needville area, Fort Bend County, by Tide Water Associated Oil Co. The well is 2 G. W. Armstrong, in the James Scott Survey 3, northeast of the Boling field, about 1 mile northeast of the company's 1 Armstrong, which was abandoned last year at a total depth of 8,593 ft.

Zingery Map Co., Houston

***Strake Petroleum Co.* 1 Griffith, a wildcat in Brazoria County, which is expected to open a new field in the Halls Bayou area**

TEXAS GULF COAST COMPLETIONS

Brazoria County

Old Ocean field: Harrison & Abercrombie 1 Birky-Chenault, 191 bbl., ¼-in. choke, top sand 10,001 ft., T.D. 10,524 ft.
West Columbia field: Hogg Oil Co. 6-A Hogg, dry, T.D. 5,623 ft.

Chambers County

Anahuac field: Humble 6 Knowles, 221 bbl., ¼-in. choke, top sand 7,140 ft., T.D. 7,058 ft.
Red Fish Reef field: Gulf 1-R-224 State, 120 bbl., ½-in. choke, perf. casing 10,435-40 ft., T.D. 11,008 ft.
Humble 5-A-265 State, 110 bbl., ½-in. choke, perf. casing 10,380-95 ft., T.D. 11,008 ft.
Humble 10-A-249 State, junked, T.D. 10,477 ft.

Hardin County

Sour Lake field: H. F. Baker 4 Glass, 48 bbl., plus 53 per cent salt water, pumping, top sand 1,817 ft., T.D. 1,830 ft.
Chambers & Edwards 1-A Higgins, 94 bbl., pumping, top sand 1,583 ft., T.D. 1,595 ft.

Harris County

Tomball field: Humble 3 Krahn, 358 bbl., ¼-in. choke, top sand 5,566 ft., T.D. 5,581 ft.

Jackson County

West Ranch field: Seaport 2 Stepan, 78 bbl. plus 5 per cent salt water, T.D. 5,808 ft.

Jefferson County

South China field: Sun 1 Broussard, 86 bbl., ¼-in. choke, perf. casing 7,890-93 ft., T.D. 7,918 ft.

Liberty County

Esperson field: W. P. Luse 5 Hlavaty, gas well, T.D. 7,057 ft.
Wildcat: Dishman-Lucas 1 Robertson, top Cockfield 6,905 ft., Discorbis Yeguaensis 7,045 ft., Eponides Yeguaensis 7,188 ft., dry, T.D. 7,510 ft.

Matagorda County

Markham field: Thomar 1-C R. J. Sisk, 138 bbl., 11/64-in. choke, top sand 3,160 ft., T.D. 3,175 ft.

(Continued on Page 230)

REPUBLIC RUBBER PRODUCTS

BUILT FOR REFINERIES
PREFERRED BY REFINERIES

To meet the exacting needs of Oil Refineries for mechanical rubber products—Republic manufactures a distinct line of hose and belting with constructions adapted to a long service life under the particular operating conditions. The background of these rubber products for Refineries includes extensive research and field observations . . . painstaking development of rubber compounds and other materials with the most desirable physical and mechanical properties . . . and ceaseless scientific control during manufacture. The advanced service capacity thus obtained has won widespread preference for Republic Air Hose, Steam Hose, Gasoline Hose, Water Hose, Chemical Hose and Fire Hose—as well as Conveyor Belting with special heat-resisting qualities for handling hot fuller's earth or bauxite. Wherever complete protection against oil or gasoline is required, Republic will furnish any type of hose with neoprene tube or cover.

• • •

REPUBLIC RUBBER DIVISION OF LEE RUBBER AND TIRE CORPORATION, YOUNGSTOWN, OHIO.

DISTRIBUTORS
Frick-Reid Supply Corporation, Tulsa, Okla.
The Bovaird Supply Company, Tulsa, Okla.
W. C. Hendrie & Company, Inc., Los Angeles, Calif.
Pacific Coast Rubber Co., San Francisco, Calif.

REPUBLIC RUBBER
LEADERSHIP IN POLICY PRODUCT AND PERFORMANCE
HOSE • BELTING • PACKING • MOLDED PRODUCTS

Wildcatters Active as Proven Areas Approach Flush Stage

By
ROBERT INGRAM

RANK wildcat drilling was under way in virtually every section of the state this week as routine development struck a low mark. Of the 18 wells completed, only 11 were producers with an aggregate initial of 6,735 bbl. a day. Most of the new wells were still being completed at the new Cumberland pool, the Seminole area, the West Hewitt pool in the southwestern part of the state and in Okfuskee County. There was also some drilling at Oklahoma City and in the east-central areas, but for the most part, in spite of the new discovery at Guthrie, operators were on the search for new territory.

One of the most interesting of the new starts was that announced by Ramsey Petroleum Corp. in the Centrahoma district of Coal County. Ramsey said it would drill to 5,000 ft., or to the Cromwell sand, just northwest of the Centrahoma townsite in W½ SE NW 27-2-9, on the Harryman lease. The location is about 40 acres north of the Carter Oil et al 1 Clayton which drilled to 6,722 ft. several years ago and was plugged back to 6,480 ft. to make a small distillate producer.

Just southwest of the town, Carter et al 1 Thompson, NE NW 34-2-9, went to 6,330 ft. to make another small producer. However, Carter apparently lost interest in the structure, which was mapped several years ago by Ramsey as covering about 12,000 acres, and the company dropped most of its holdings. Ramsey now is reassembling about 1,000 acres around the new location.

Another test to be spudded by April 1 was Guy Hannum et al 1 Little, E½ NE SE 16-3-1, near Pauls Valley in Garvin County. The location is on a block of 3,000 acres, much of which has been leased several times during the last 15 years and has been mapped by geophysicists several times. Contract is for 5,000 ft. or the Arbuckle lime.

Several Tests Drilling in Logan County

Another new test was reported scheduled by Continental Oil Co. southwest of Seward in southern Logan County on the Carl Ford lease in SW SE SW 17-15-3w. In the same general area, Jay E. Jones et al have spudded at 1 Bosserman in SE NE SE 22-15-3w, about two locations north of Sinclair Prairie 1 Koetsch, discovery well. Both are to go to the Wilcox.

North of the Lovell townsite, Kerlyn 1 Wareing, SW NE SW 33-19-4w, was drilling in shale below 3,180 ft., and in the new Guthrie pool, Continental 1 Donoghue, NE NE SW 7-17-1w, west of the discovery, and Sinclair Prairie 1 Sultz, SW SW NE 7-17-1w, were getting started.

Osage County, one of the state's older areas, was also being tested again in several locations. Norbla Oil Co., Black Jack Oil Co., Superior Oil Co. and Stanolind were all testing various structures under the Indian lands (see drilling report below).

Meantime, operators in Okfuskee County were given an opportunity to learn much about subsurface conditions in the Droppleman pool, north of Dill, at spacing hearing before the state Corporation Commission in Oklahoma City. At the hearing, M. W. Lee and H. E. Lee, operators in the Droppleman pool, were asking for an exception to the 10-acre spacing order which would permit them to drill west of the center of their drilling unit in NW NE NW 35-12-8.

The location, for Lee & Lehmer, would be a north offset to 2 Lehmer, for which an exception was granted several months ago because the operators showed there was reason to believe the unit was cut by a fault to the east. Geologic tops, production and completion practices and other information was presented by both the Lees and interests opposing the exception request and other Okfuskee County operators were on hand to learn all they could.

Okfuskee County has been one of the most attractive areas in the state and is relatively easy to drill. Production is found from 3,000 to 3,500 ft., and most of the drilling is done with 3-in. drill pipe and light equipment. Several portable rigs are in operation in the area.

Last week, the K. G. F. F. Oil Co. 1 Camp, SW SW SW 6-11-9, a mile east of the Droppleman pool, was completed as a discovery well with 250 bbl. a day of 43-gravity crude through a ½-in. choke on tubing. Casing pressure was 500 lb. Drilled to 4,010 ft., casing was set on bottom and perforated at 3,950-60 ft. in the Hunton, topped at 3,915 ft. There were indications, however, that the new pool would be small as it is surrounded by dry holes within a mile radius.

SUMMARY OF COMPLETIONS

	No.	Bbl.	Footage
Oil wells: Cumberland	1	438	5,077
West Hewitt	3	1,159	6,318
Other fields	6	2,694	19,815
Wildcats	1	2,444	5,445
Dry holes: Oklahoma City	1	.....	6,510
Other fields	6	.....	14,150
Total	18	.....	57,315
Recompletions	1	40	.....

AVERAGE DAILY PRODUCTION

LEADING OKLAHOMA FIELDS

	Mar. 22	Mar. 15
Allen	4,650	4,650
Billings	6,200	6,250
Burbank	7,350	7,375
South Burbank	7,450	7,475
Balance Osage	16,250	16,975
Blackwell district	3,500	3,550
Bristow-Slick	6,300	6,425
Chandler	1,025	1,000
Crescent	1,975	2,025
East Cromwell	3,025	2,575
Cromwell	2,925	3,050
Cumberland	6,100	5,250
Cushing-Shamrock	8,825	9,025
Dill	6,500	5,225
Duncan	3,600	3,650
Edmond	3,525	3,550
Fish	2,625	2,725
Fitts	12,100	13,100
Jesse	1,875	1,900
Graham-Fox	2,125	2,200
Healdton	8,625	8,675
Hewitt	8,050	8,150
Keokuk	2,825	2,925
Konawa	950	1,050
Lucien	5,675	5,675
Moore	1,025	975
Northeastern counties	16,950	17,300
Oklahoma City	93,350	83,225
Olympic	1,725	1,775
Ramsey	3,525	3,525
Sasakwa	1,325	1,350
Sholem-Alechem	2,600	2,675
Seminole district:		
Bowlegs	6,275	6,250
Carr City	2,325	2,200
Dora	1,250	1,375
Earlsboro	3,925	3,950
East Earlsboro	1,650	1,725
South Earlsboro	450	475
Little River	6,325	6,350
East Little River	650	675
Mission	1,250	1,275
Seminole	6,425	6,450
East Seminole	950	1,075
Searight	1,750	1,775
Total Seminole	33,225	33,575
St. Louis-Pearson	19,250	20,250
Tatums-Tussy	5,525	5,550
Tonkawa-Garber-Thomas	3,550	3,575
Wewoka	1,675	1,750
Yale-Jennings	3,225	3,275
Total Oklahoma	402,150	398,675

OKLAHOMA COMPLETIONS

Bryan-Marshall Counties

Cumberland pool: Pure 2 Thomas, NE NW 28-5s-7e, flowed 438 bbl. in 3 hr., pay 4,826 ft. and 4,945 ft., 7-in. 4,936 ft., T.D. 5,077 ft.

Carter County

West Hewitt pool: Daube 1 Daube, NW SW SW 17-4s-2w, flowed 395 bbl. in 21 hr., sand 2,064-84 ft., T.D. 2,104 ft.

Daube 2 Daube, NW SW SW 17-4s-2w, flowed 434 bbl. in 17 hr., sand 2,093 ft., T.D. 2,134 ft.

Neustadt 1 Choate, N½ SE SE 18-4s-2w, flowed 330 bbl., sand 2,065-80 ft.

Hewitt pool: Dixon 1-A Woodworth, E½ W½ NE NW 20-4s-2w, pumped 15 bbl., T.D. 2,404 ft., P.B. 2,260 ft.

Healdton pool: Magnolia 87 Richards, SE NW NE 6-4s-3w, dry, T.D. 1,287 ft.

Creek County

Mannford district: Tulsa Oil 1 Thompson, NW SW 12-19-9, dry, T.D. 1,936 ft., Oswego 1,704 ft., Prue 1,788 ft., Skinner 1,916 ft.

Miscellaneous: Thomas 2 Richards, SE SE 36-18-9, old well drilled deeper from 1,926 ft., Wilcox 3,131-50 ft., T.D., dry.

Grady County

Knox pool: Magnolia 4 Harrison, SE NE NE 28-3-5w, old well drilled deeper from 2,510 ft. to 2,545 ft., T.D., sand 2,543 ft., pumped 40 bbl.

Hughes County

Allen pool: Huddleston 1 Bentley, SE SE 28-5-8, dry, T.D. 898 ft.

Kay County

Ponca City pool: Continental 1 Cry, NW SE 7-2s-2, dry, T.D. 3,857 ft., Mississippian chat 3,788 ft., Mississippian lime 3,810-57 ft., swabbed 1¼ bbl. of oil a day.

Logan County

Wildcat (Guthrie): Sunray 1 Donoghue, NW SE 7-17-1w, potential 2,444 bbl., second Wilcox 5,425-45 ft. T.D., 7-in. 5,423 ft.

Okfuskee County

Weleetka pool: Doak 5 Lowe, SW SE NE 16-10-11, flowed 125 bbl., sandy limestone 2,850-62 ft., T.D.

West Okemah pool: Skelly 1 Wesley, SW NW 21-11-9, flowed 393 bbl., 44 gravity, Cromwell 3,451-70 ft., Hunton 3,955 ft., show oil 4,006-47 ft., T.D.

Oklahoma County

Oklahoma City: Zeb 1 Highland, NW SW SE 26-12-3w, temporarily abandoned, T.D. 6,510 ft., P.B. 6,320 ft., shot, 7-in. 6,171 ft., sand 6,227 ft., 6,310 ft. and 6,450 ft., lime 6,495 ft.

Seminole County

East Little River pool: Hall 1 McKenzie, SE NE 14-7-7, dry, T.D. 3,346 ft.

Fish pool: Mid-Continent 2 Ferguson, NE NW NW 19-7-8, pumped 335 bbl., Cromwell 3,478-91 ft., T.D., P.B. 1,536 ft.

Wewoka: Magnolia 7 Lena, NW SW 32-8-8, flowed 60 bbl., sand 1,915 ft., T.D. 1,930 ft.

West Seminole: Dunnett 2 Duncan, SE NW NE 33-9-6, dry, T.D. 2,826 ft.

Tillman County

West Frederick pool: I. T. I. O. 7 Dickey, W½ W½ NW 1-3s-19w, flowed 1,766 bbl., Viola 4,800 ft., Arbuckle 5,004 ft., best pay 5,080-81 ft., T.D.

OKLAHOMA DRILLING REPORT

Creek County

Jackson 1 Prince ..... SE SE NE 26-19-9
Drilling 679 ft., 10-in. 678 ft.

Bryan 1 Corbray ..... NE NE NW 34-19-9
Sand with some show oil and gas and water 1,995 ft., drilling 2,005 ft. shale.

Ray Starr 1-A Lumm ..... SE NW SE 8-14-8
T.D. 2,857 ft., perf. 2,464-70 ft. and 2,420-45 ft., no show, S.D.

Jackson County

Mutual 1 Caves ..... W½ NE NW 36-4-21w
S.D. 1,220 ft. in granite wash.

Kiowa County

Artie Baker 1 Coakley ..... NW NE SE 30-7-17w
T.D. 1,287 ft., testing est. 10 to 15 bbl., pulled tubing and S.D.

Lincoln County

K. G. F. F. 1 Adams ..... SW NW SE 3-14-4e
T.D. 5,059 ft., perf. 2,795-98 ft., some show oil, perf. 4,796-4,801 ft., filled 3,500 ft. with water and some show oil, swabbed salt water.

Helmerich & Payne 1 Hennessey NW NW SW 23-16-3
First report.

Logan County

Kerlyn Oil 1 Wareing ..... SW NE SW 33-19-4w
Drilling 3,045 ft.

Muskogee County

Stormfeltz 1 Weimer ..... NW SW NW 16-13-16
First report.

Noble County

Adams 1 Albright ..... SW SW SE 31-23-2w
S.D. 1,300 ft., contract out.

Okfuskee County

Carte 1 Bucco ..... NE NE SE 20-10-12e
Show oil and gas 2,490-91 ft., hole full water 2,491-92 ft., T.D. 2,503 ft.. 5½-in. 2,503 ft.

Dave Malernee 1 Beard ..... SE SW NE 7-11-8
First report.

K. G. F. F. 1 Camp ..... SW SW SW 6-11-9
T.D. 3,380 ft., flowed 77 bbl. in 7 hr. through casing, flowed 90 bbl. in 10 hr. through casing with tubing in hole, fishing tools in tubing.

Alma 1 Replogle ..... NW SW NW 14-11-10
Drilling 154 ft.

Texas 1 Butcher ..... NW SE NW 15-12-9
Drilling 1,510 ft., 10-in. 210 ft.

Root & Anderson 1 Parlos ..... NW NW SE 30-12-8
First report.

Oklahoma County

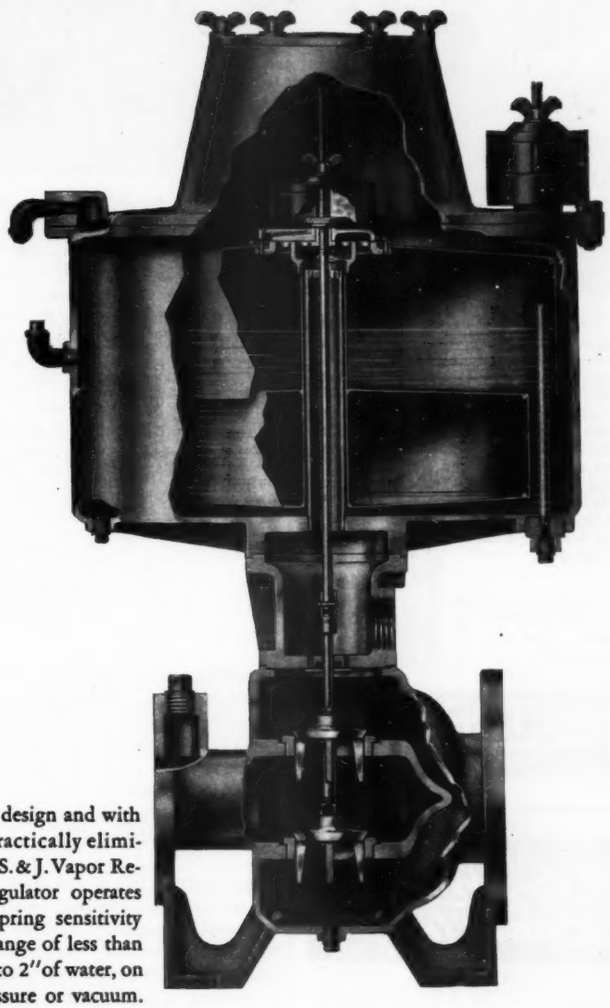
Clyde Dorr 1 Riley ..... NE NE SE 34-13-1
S.D. 5,921 ft., sandy dolomite 5,797 ft., first Wilcox

(Continued on Page 229)

For Safety—
as well as
CONSERVATION

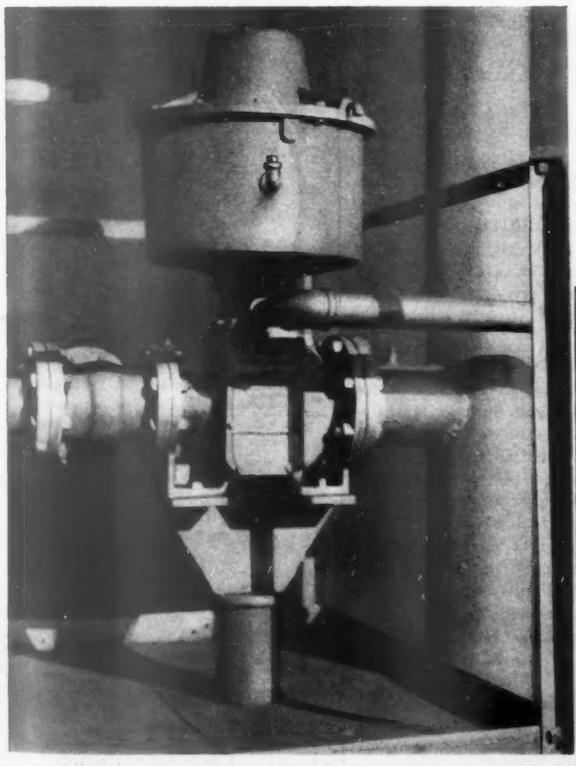
ALTHOUGH conservation of valuable vapors is the primary object of a vapor recovery system, the greater fire safety that follows in the wake of checking these evaporation losses is obvious to every petroleum engineer. The S. & J. Supersensitive Vapor Recovery Regulator, illustrated in section at the right, is the key piece of equipment in conserving vapors which yield a high return on the equipment investment, plus an even greater return in the safety of a gas-free atmosphere. Fully illustrated and described in our Bulletin No. 772. It will be sent to you on request.

SHAND & JURS COMPANY
BERKELEY · CALIFORNIA
NEW YORK · CHICAGO · HOUSTON · LOS ANGELES

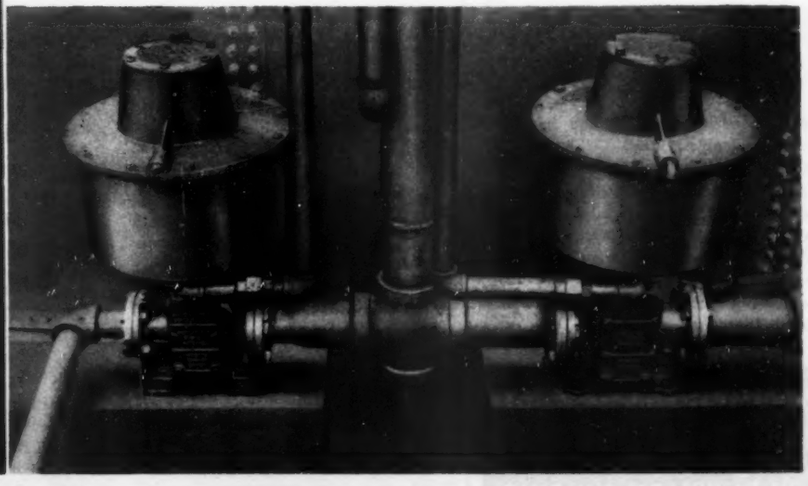


Simple in design and with friction practically eliminated, the S. & J. Vapor Recovery Regulator operates with hairspring sensitivity within a range of less than 1/10″ up to 2″ of water, on either pressure or vacuum.

When repressuring is not required, a single S. & J. Vapor Recovery Regulator is used to control the outflow of vapors.



When tanks are repressured with dry gas, two S. & J. Regulators are used, one to control the admission of dry gas, the other to control the removal of vapor. One regulator set-up may be employed to service a battery of tanks, the only limitation being the capacity of the valve to handle the volume of vapor. This Regulator available in 2″, 3″, 4″, 6″, and 8″ sizes.



SHAND & JURS

"Temporary fuel or water lines from the source of supply to your location will waste a lot of money through leaky joints during one drilling job. RECTORSEAL, applied to every threaded or coupled joint, will prevent these leaks. It will also prolong the life of your pipe threads and will cut labor time on making up and dismantling the lines in the long run. Yes sir, you'll not only save far more than the RECTORSEAL cost you . . . you'll make a profit on the deal.

"Your Supply Store has RECTORSEAL in handy sizes to fit your needs."

RECTORSEAL
THE POSITIVE LEAK PREVENTER

WEB WILSON
Rotary Tongs

SPEED UP ROUND TRIPS
WITH THESE DEPENDABLE,
POSITIVE GRIPPING TONGS

With a minimum of wearing parts and interchangeable jaws, WEB WILSON Rotary Tongs will grip positively on drill collars and badly worn tool joints without jaw change. Made of special, high strength, heat-treated steel, WEB WILSON Rotary Tongs are unsurpassed for safety and convenient operation. Available in extra-heavy and regular types to fit all sizes of drill pipe. Literature on request.

WEB WILSON
Oil Tools
W. W. WILSON BUILDING
HUNTINGTON PARK, CALIF.

Among the Drilling

ALLEN & MORRIS, San Antonio, Tex., are preparing to test Coronado Corp. 20 State in the Duck Bay field, Calhoun County, Texas. Contract was received from W. R. R. Oil Co. for 7 State, to be drilled in the East White Point field. Drilling continues below 8,600 ft. in H. Brown 1 Louisiana, located in Lincoln Parish, Louisiana. Three other operations are reported in the West Ranch, Agua Dulce and Willamar fields for Darby Petroleum Co., Shasta Oil Co., and the Pan American Production Co.

HASSIE HUNT has erected derrick for the Jones & Hunt 1 Germany, NE NE 19-10n-2w, in the Tinsley field of Yazoo County, Mississippi.

HENDERSON COQUAT, San Antonio, Tex., is preparing to spud Texas Conservative 3 Huie, an important test located in the South Clara Driscoll field. In the Sejita area, Duval County, Texas, drilling was started on the contractor's 1 Garcia, a Cockfield test.

GEORGE ECHOLS, Houston, Tex., has moved two additional rotaries to the newly opened St. Gabriel field, Iberville Parish, in the Louisiana Gulf Coast district. The wells are 1-A Gueymard, 2-A Natalbany and 3-A Natalbany, all of which offset the discovery well which was completed by the contractor a few weeks ago. In the Double Gum area, Liberty County, Texas, the contractor's 2 Boyt is being retested after salt water was recovered on a production test.

RHODES Drilling Co. and Atlantic Refining Co. 1 Dean, extension producer west of the south end of the Duggan-Slaughter field in Cochran County, Texas, pumped 246 bbl. of fluid, including 84 bbl. of water, on a 24-hour pumping gage last week.

F. & M. Drilling Co., a new contracting firm, has been organized in Oklahoma City, Okla., by Joe Brown, president of the Brown Supply Co. and C. E. Farris. The company, organized with $100,000 capital, takes its name from the initials of the founders' wives, Mrs. Flossie Farris and Mrs. Marcella Brown.

JOHN DEERING, Houston, Tex., is nearing the contract depth in O. J. McCullough 1 W. S. Swilley, a wildcat located in the Sheldon area, Harris County, Texas. The well is drilling below 4,000 ft., and is reported to have logged a possible gas show up the hole.

WILLIAMS & GREEN, Inc., Duncan, Okla., have contract to drill a wildcat test for Ace Gustowsky of Oklahoma City, Okla., on the Payne farm, NE SW SE 25-3n-26w, Scott County, Arkansas. The location is 1½ miles southwest of an old test drilled in 1929 which showed 1,000,000 cu. ft. of gas in sand at 1,448 to 1,518 ft. Also there were showings of oil at 2,106-36 and 2,265 to 2,372 ft.

JIM GREATHOUSE Houston, Tex., is drilling below 7,900 ft. in search of the Wilcox sand in W. R. Davis 2-C Albrecht, located in the Weser area, Goliad County, Texas.

ARROW Drilling Co., Tulsa, and J. P. Walker will start a northern Hughes County, Oklahoma, wildcat operation April 1, about 6 miles east of Wetumka in SW NW SE 23-9n-11e. A test of Cromwell sand is proposed.

CLYDE D. LANE, Cross Plains, Tex., contractor, has started an Ellenburger lime test in Mills County, Texas, 3 miles southeast of Ebony and 20 miles southeast of Brownwood on the B. N. Egger 166-acre farm, William Hayes Survey 4.

PRINCE Drilling Co., Gladewater, Tex., has applied for special permit to drill on a town lot in Ore City, Upshur County, Texas.

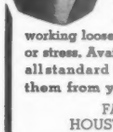
HENSHAW BROTHERS, San Antonio, Tex., are rigging up in La Salle County, Texas, for Barnsdall 1 G. W. Sager, a projected Wilcox test located west of Atlee in Survey 903.

RED IRON Drilling Co. is dismantling rig at 1 Prince, a test in the Edward Wideman Survey, Hawkins field, Wood County, Texas, which will be completed as a pumping well after swabbing 7 bbl. of oil an hour. It is 1 mile west of the Hawkins townsite.

STICE Drilling Co., Beeville, Tex., extended gas-distillate production in the Benavides field, Duval County, Texas, about 2,000 ft. east, with the completion of Hiawatha Oil & Gas Co. 30 Parr.

TIPPETT Drilling Co., Shreveport, La., has contract for deepening K. E. Jennings et al 1 Wood, a wildcat test in the SW NE 33-18-28, Miller County, Arkansas. The hole was drilled

"Tough as an alley cat for wear—as soft to handle as a kitten"



Elastic Stop SELF-LOCKING NUTS

FOR drilling, pumping, and other oil field equipment. Resilient locking collar prevents working loose under any condition of vibration or stress. Available in numerous types, all sizes, all standard threads, and any material. Get them from your supply house.

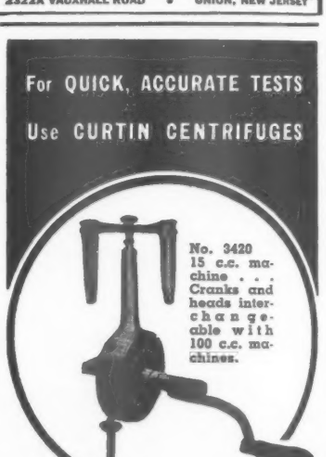
FACTORY STOCKS IN
HOUSTON AND LOS ANGELES

Safe . . . Reliable . . . Economical

• Write for Catalog

ELASTIC STOP NUT CORPORATION
2322A VAUXHALL ROAD • UNION, NEW JERSEY

For QUICK, ACCURATE TESTS
Use CURTIN CENTRIFUGES



No. 3420 15 c.c. machine . . . Cranks and heads interchangeable with 100 c.c. machines.

Simple in design . . . Ruggedly built . . . Require no special care . . . Great Ratio and throw of crank produce required speed with no strain. Curtin Centrifuges meet all *A.S.T.M. Standard Method D-96-35* and *A.P.I. Code No. 25* requirements. Fully descriptive literature upon request.

W·H·CURTIN & CO. Inc
HOUSTON USA TEXAS

Always Renew Your Subscription Promptly

Contractors

to 4,562 ft. in Paluxy last summer. Before deepening starts, a drill-stem test is to be made of the Fredericksburg lime from 4,020 to 4,130 ft.

MORRIS HAMILTON Drilling Co., Houston, Tex., is starting an interesting wildcat in the Lake View area, Wharton County, Texas, for W. R. Davis Co., Inc. The well is 1 Hartman in the I.&G.N. Survey, about 3 miles north of the town of El Campo.

BRYAN PATTERSON, Laredo, Tex., is drilling a wildcat test for Bob Newton on the Vohpahl fee, ¾ mile southwest of the nearest production in the Elm Creek field of Guadalupe County, Texas.

SAWYER Drilling Co., San Antonio, Tex., is preparing to start a 3,200-ft. test in Jim Hogg County, Texas, northeast of the Manila field.

CARL B. KING Drilling Co., Dallas, Tex., has farmed out an 80-acre lease on the Hazel C. Strand farm 6 miles east of Stamford, Tex., on the Jones-Haskell counties line to J. C. Hunter, Abilene, Tex., operator, who is moving in material for exploration.

VERN KNISELY of Garetson-Knisely, Inc., Rocky Mountain drilling contractors, accompanied his Knisely-Moore sponsored basketball team to Denver, Colo., last week for the national A.A.U. basketball tournament. His team had won the Wyoming State A.A.U. tournament at Douglas the previous week, but were defeated in the first round of play at the Denver tournament.

E. E. STEVENSON, drilling contractor of Tyler, Tex., has built derrick and moved in materials for a 2,500-ft. Carrizo-Wilcox wildcat test in the John Chears League of Houston County, Texas. The test is being drilled for G. C. Dixon of Crockett, Tex., and is on the 230-acre Texas Long Leaf Lumber Co. tract, 850 ft. from the northwest line and 498 ft. from the west line. It is 5 miles northwest of Lovelady, on a 3,000-acre block.

MANNING & MARTIN of Denver, Colo., are nearing completion of Investors Oil Co. 31 Government in the South Casper Creek field of Natrona County, Wyoming. Located in NW NW SW 2-33n-89w, the test at last reports was drilling in with 7-in. casing set at 2,338 ft. The company also has contract to drill the Investors 32 Government, in SE SE NE 3-33n-89w, after completion of 31 Government.

L. & S. Drilling Co., Detroit, Mich., last week brought in a 2,200,000-cu. ft. gas well at the Burruss & Quinlan 1 Winesburgh in Isabella County, Michigan. Located in SE SW SW 20-14n-5w, in Deerfield Township, the wildcat was originally scheduled to test the Dundee. However, the stray was picked up at 1,285 ft. and showed gas from the top with the flow increasing to 1,292 ft., total depth. Only about 8 miles west of Mount Pleasant, the discovery is well located for a comparatively ready outlet.

W. B. OMOHUNDRO, drilling contractor of Wichita Falls, Tex., is drilling below 700 ft. at his 1 Vaughan, 2 miles southwest of the town of Tolbert, in Wilbarger County, North Texas. The 6,000-ft. test is in Section 29, H.&T.C.R.R. Survey, Block 16, in the west 244 acres out of the south 366 acres of the section.

CLIFF NEELY, Bay City, Mich., at last reports was testing Don Rayburn 1 Sonnenberg in the Adams field of Arenac County, Michigan. Bottomed at 2,993 ft. in the Dundee (topped at 2,845 ft.), the well was estimated as a 60-bbl. producer, natural. The 1 Sonnenberg is located in SE NE SW 23-19n-3e. At Rayburn 2 Collins in SE NW NE 22, hole was lost at 2,870 ft. and rig may be skidded to start new hole. Also in Section 22, Neely was testing Rayburn & Major 1 Codner, which topped the Dundee at 2,877 ft. and is bottomed at 3,001 ft.

TANNER & RYAN, contractors on the City of Canton 1 State in Hinds County, Mississippi, last week completed the well for an estimated 10,000,000-cu. ft. gas well. The well logged the black shale at 2,328 ft., chalk at 2,424 ft., and set 5-in. casing at that depth.

TWIN Drilling Co., Grand Haven, Mich., has been awarded contract for drilling Michigan Cities Natural Gas Co. 1 Diehl and is moving in materials. The well is located in the Broomfield area of Isabella County in C SE 15-14n-6w.

E. M. SHIELDS, drilling contractor of Mount Pleasant, Mich., at the last of the week was moving in materials for Socony-Vacuum Oil Co., Inc., 3 Weber in the Salem field of Allegan County, Michigan. The 3 Weber is located in NW NE NW 14-4n-13w. At the Socony-Vacuum 3 Green the contractor has erected machine and at 2 Green was nearing completion following acidizing.

PARKER BROTHERS, Shreveport, La., have spudded a test for Magnolia Petroleum Co. in Lauderdale County, Mississippi. The test is 1 Culpepper, 330 ft. north and east of the SW cor. of Lot 7, 4-8n-14e.

BIG WEST Drilling Co. of Dallas, Tex., is moving in rig to drill British American Oil Co. 1-A Houston in 23-11n-7w, Sharkey County, Mississippi. The well will be an offset to 1 Houston, junked at 4,027 ft. in the Tuscaloosa with a show of live oil in the hole.

NOBLE Drilling Co., Ardmore, Okla., has contract to drill Guy Hannum et al 1 Little, E½ NE SE 16-3-1, near Pauls Valley in Garvin County, Oklahoma. The well is to go to 5,000 ft. or to the Arbuckle lime.

OLSON Drilling Co., Tulsa, has been awarded contract for a 5,000-ft. test on the Centrahoma structure in Coal County, Oklahoma. The well will be Ramsey Petroleum 1 Harryman, W½ SE NW 27-2-9.

SAM VIERSON at last reports was coring below 5,960 ft. in the Wilcox at the Waggoner Brothers Oil Co. 1 Brander in Warren County, Mississippi. Located in NW NW 17-14n-1e, the 7,000-ft. contract test topped the Tallahatta at 3,080 ft. and the Wilcox at 3,360 ft.

PORTABLE Drilling Co., Tulsa, held an interest in K. G. F. F. Oil Co. 1 Camp, a pool opener completed this week in SW SW SW 6-11-9, Okfuskee County, Oklahoma, for 250 bbl. a day.

PAT HUDSON, Gladewater, Tex., has been awarded contract for drilling a 7,500-ft. wildcat 4 miles southeast of Hawkins in Upshur County, Texas. The test is to be drilled for Universal Oil, Gas & Mining Co., the 1 W. B. Gorman, and is located on the 100-acre tract in C. J. Slayton Survey.

DELTA Drilling Co., Tyler, Tex., at the week end was drilling below 6,150 ft. on its deep wildcat 4 miles north of Henderson in Rusk County, eastern Texas. The test is its 1 Kangerga Brothers, in R. Lane Survey, and will test the Glen Rose, Pettit and Travis Peak, the latter expected at about 8,200 ft.

WHAT'S NEW
IN TURBINE PUMPS

UP-TO-THE-MINUTE FACTS
FOR PUMP BUYERS

FROM THE GROUND *DOWN*
PEERLESS OFFERS
OIL OR WATER LUBRICATION
—Take your choice
CHROME ARMORED BEARING
—Practically indestructible
PATENTED DOUBLE SEAL
—Adds years to pump life
DOUBLE BOWL BEARINGS
—Stabilize impellers and shaft, prolonging pump life
MAINTAINED HIGH EFFICIENCIES
—For the life of the pump
WIDE CAPACITY RANGE
—In turbine types up to 15,000 g.p.m., others up to 100,000 g.p.m.
WIDEST RANGE OF SIZES
—For all deep wells, 4" or larger

FROM THE GROUND *UP*
PEERLESS OFFERS
ALL FORMS OF DRIVE
—Direct motor connected, belt and right angle gear drive
SUPER-SERVICE
—In all pumping districts
PROMPT DELIVERIES

Ask for Literature

PEERLESS TURBINE PUMPS
ALSO AVAILABLE IN HI-LIFT AND PROPELLER TYPES, CAPACITIES UP TO 100,000 G.P.M.

PEERLESS PUMP DIVISION—
Food Machinery Corp.
Factories: Los Angeles, San Jose, Fresno, Calif. and Canton, Ohio.

"WEIGHT INDICATOR POINTS"

Accuracy . . . Sensitivity . . . Readability . . . Dependability. Do your slush pump gauges combine all these requirements? The Martin-Decker Individual and Unitized oil-filled Slush Pump Gauges do!

You get *accuracy* throughout the range—*sensitivity* adjustable to your desire. The position of the pointer is readable 40 or 50 feet away—you can know the pressure even though you can't distinguish individual figures on the dial. And dependable performance is guaranteed by the pioneer oil field instrument manufacturer—Martin-Decker!

MARTIN-DECKER CORP.
LONG BEACH, CALIFORNIA
SAN JOAQUIN VALLEY: A. F. McQUISTON, BAKERSFIELD, CALIFORNIA
MID-CONTINENT DISTRIBUTOR: REED ROLLER BIT CO., HOUSTON, TEXAS

By
ROBERT INGRAM

New Horizon at Stafford, Two New Pools Mark Active Week

THE oil business in Kansas continued on the upswing this week with production at a new high, drilling increasing in all areas and a reduction in freight rates to midwestern points ordered by the Interstate Commerce Commission. Among new wells completed were two that opened new pools in western Kansas, and two more in testing stages were showing for new discoveries.

Meantime the northeastern part of the state drew attention as Alf M. Landon stated that that section was "on the verge of the biggest drilling campaign for oil and gas that it ever has experienced." He mentioned particularly Jefferson, Brown and Nemaha counties and pointed to the fact that "Jefferson County now has an open flow of 40,000,000 cu. ft. of gas daily from five wells and it has one oil well producing from the top of the Mississippi lime."

Occasion for Landon's statement was the completion of a pipe-line outlet from the five gas wells completed since last winter north of the town of McLouth (see p. 210). Cities Service has agreed to purchase up to 10,000,000 cu. ft. of gas a day. While the gas production was regarded as important, townsfolk at McLouth were more interested in a small oil well in the same field, Young & McLaughlin 1 McLeod, and in the fact that another well is drilling on the McLeod farm where the discovery oil well was brought in last May. Production from the oil well is being sold locally as fuel oil and road oil.

The new pool openers completed this week were Republic Natural Gas Co. 1 Radenberg, NW SE 8-17-11w, west of the Kraft pool in Barton County, and Atlantic Refining Co. 1 Shaeffer, NW SW 3-21-13w, 3¼ miles southeast of the Hiss pool in Stafford County. Republic 1 Radenberg was a small well which was given a potential of 68 bbl. a day from Arbuckle lime at 3,332 ft. Although it was classified by state conservation officials as the discovery well of the West Kraft pool, it was considered likely that eventually it would be joined to the Kraft pool proper which is one of the leading areas of the state.

Atlantic 1 Shaeffer, given a potential of 1,175 bbl. daily after acid treatment, was listed as the discovery well of the Shaeffer pool. It is producing from the Arbuckle dolomite at 3,552 ft.

SUMMARY OF COMPLETIONS

Kansas

	No.	Bbl.	Footage
Oil wells: Bemis-Shutts	2	373	6,803
Bornholdt	1	70	3,336
Burnett	1	3,000	3,353
Edwards	2	6,000	6,456
Geneseo	1	1,988	3,229
Hall-Gurney	3	1,816	8,843
Silica	1	236	3,276
Trapp	2	3,627	6,441
Zenith	1	1,595	3,767
Other fields	9	5,566	29,261
Wildcats	1	1,175	3,552
Gas wells: Fields	3	*48	8,498
Dry holes: Trapp	1	.....	3,380
Other fields	7	.....	18,515
Wildcats	3	.....	8,870
Total	38	.....	117,580

*Million cu. ft.

Two Wildcats Test Oil Shows

Stafford County had a second important development during the week at the Stafford pool, a 1940 discovery in the Viola lime, when Stanolind 4 Charles, N½ SW SE 15-24-12w in the Stafford townsite, apparently opened the first production from the Arbuckle dolomite. The well topped the Arbuckle at 3,945 ft., cored from 3,945-55 ft. and recovered 7 ft. of dolomite with fair porosity and a showing of oil. Operators set 5½-in. casing for a production test. The well found the Arbuckle 49 ft. structurally higher than did the discovery well of the pool which was completed in the Viola.

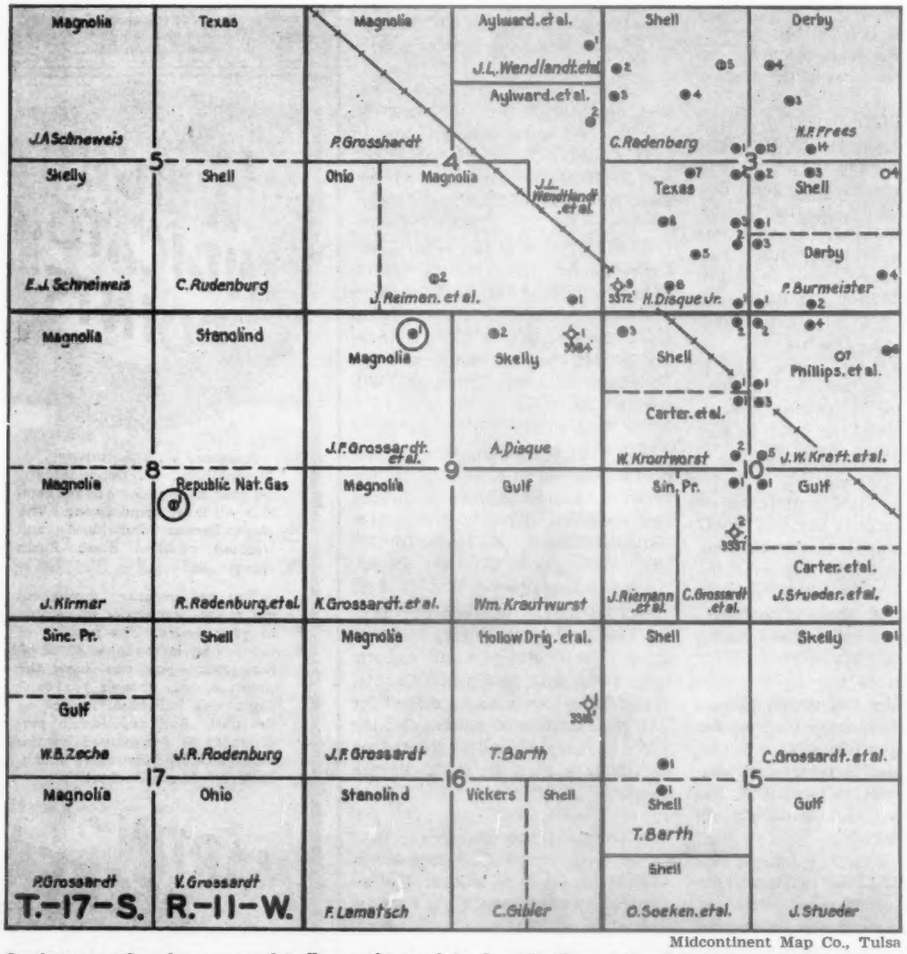
At a semiwildcat 5 miles northeast of the town of Hays in northern Ellis County, Derby Oil et al 1 F. Miller, S½ SW SW 17-13-17w, apparently opened Arbuckle production after it cored 1 ft. of saturation from 3,645-46 ft. Casing was set for a production test. Crow Drilling Co. owns a quarter interest in the test which was located on acreage farmed out from Darby Petroleum Corp. The well is 2½ miles southwest of the Catharine pool, and the same distance southeast of the Ubert pool.

Field interest in the Macksville area of Stafford County lagged after a drill-stem test on Stanolind 1 Nagel, E½ NE SW 3-24-15w, recovered only mud and water. The well topped the Viola lime at 3,966 ft., the Simpson zone at 4,064 ft. and logged saturated sand from 4,070-74 ft. A core was taken from 4,074-83 ft. which showed stained sand streaked with shale but no oil showed in a drill-stem test taken at 4,070 ft. The well was deepened to the Arbuckle at 4,100 ft., however, and a core was to be taken in that zone.

Production Trend Continues Up

Testing at the Keesling pool extensioner in Rice County, Derby Oil and Lario Oil & Gas 1 Dick, W½ SW NE 21-20-9w, continued after the well swabbed 3 bbl. of oil during a 5-hour test. Oil rose 450 ft. in 2 hours during the testing and was calculated at the rate of 5 bbl. an hour. Production was from the Arbuckle at 3,261-70½ ft.

The state's production of 216,000 bbl. for the week set a new high comparing with 207,000 bbl. produced during the last week in February of this year and 206,450 bbl. last week. The upward trend in production was expected to continue and the more favorable freight rates ordered by the I.C.C. were looked upon as especially beneficial to Kansas although other Mid-Continent producing areas were also affected.



Midcontinent Map Co., Tulsa

Another new oil pool was opened in Kansas this week by Republic Natural Gas 1 Radenberg, circled above at the left. The new pool, called West Kraft, is only a mile from Magnolia 1 Grossardt, also circled above, a recent extension to Kraft proper

KANSAS COMPLETIONS

Barton County

Straub pool: Lauck & Moncrief 1 Doll, S½ SE SE 36-18-11w, dry, 3,368 ft., Lansing 3,006 ft., Sooy 3,273 ft., Arbuckle 3,353 ft.

Trapp pool: Cities Service 2 Kosar, N½ NW SE 5-16-13w, 3,000 bbl., Arbuckle 3,364-78 ft.

Butler County

Stern pool: Cromwell & Lewis 4 Shriver, SW SW NW 34-27-6, pumped 18 bbl., Viola 3,091-99 ft.

Ellis County

Bemis pool: Gulf 2 Cress, SW SE SE 12-11-17w, swabbed 233 bbl. in 5 hr., Arbuckle 3,300-03½ ft.

Deep Rock 33 Baumer, W½ NE SE 27-11-17w, pumped 150 bbl., Arbuckle 3,481-3,500 ft.

Burnett pool: Darby Petroleum 6 Hadley, S½ NW NW 13-11-18w, 3,000 bbl., Arbuckle 3,343-53 ft.

AVERAGE DAILY PRODUCTION

LEADING KANSAS FIELDS

	Mar. 22	Mar. 15
Augusta	1,150	1,150
Bemis-Shutts	9,850	10,150
Bloomer	5,850	5,800
Burnett	6,450	6,150
Burrton	7,450	7,500
Chase	4,350	5,900
Elbing	1,050	1,050
El Dorado-Towanda	7,050	7,000
Geneseo	5,400	4,450
Graber	3,000	2,200
Greenwood County	8,600	8,550
Hollow-Nikkel	1,400	1,450
Keesling	1,500	450
Lerado	650	700
Lorraine	1,700	950
Oxford	650	700
Rainbow Bend	900	900
Raymond	1,100	1,300
Ritz-Canton	3,600	3,650
Trapp	17,450	17,650
Balance Russell County	21,000	20,500
Sedgwick County	3,150	3,250
Voshell	1,700	1,750
Silica	18,950	16,450
Wellington	1,100	1,100
Wherry	3,200	2,850
Zenith	7,250	7,100
Others	70,500	65,800
Total	216,000	206,450

Ellsworth County

Bloomer pool: Derby Oil 1 Janssen, W½ SW NE 29-17-10w, pumped 400 bbl., Arbuckle 3,263-86 ft.

Edwards pool: Continental 7 Steinberg, SW SE NW 3,000 bbl., Arbuckle 3,212-27 ft.

Continental 5 Fuller, E½ SE SE 28-17-8w, swabbed 120 bbl. in 1½ hr., 3,000 bbl., Arbuckle 3,178-3,229 ft.

Wilkins pool: Central Petroleum 2 Splitter, E½ SW NW 19-17-9w, dry, 3,277 ft., Arbuckle 3,249 ft.

Derby Oil 1 Peterman, S½ SE SE 11-17-10w, pumped 200 bbl., Arbuckle 3,264-85 ft.

Greenwood County

Keller pool: Saco Oil 1 Adams, SW NE NW 27-26-13, dry, T.D. 1,557 ft., Barton 1,435 ft., Mississippi lime 1,477 ft., pumped 2 bbl. oil per day.

Severy field: Abel & James 1 Holhimer, NE NE SW 17-28-11, dry, T.D. 1,235 ft.

Harvey County

Burrton pool: Valley Osage 2 Frederick, N½ NW NW 17-23-3w, dry, T.D. 3,398 ft., Mississippi lime 3,272 ft., est. 5 bbl. oil a day.

Leavenworth County

Wildcat: McLaughlin & Sons 1 Thorp, NE NE 27-10-20, dry, T.D. 2,209 ft., Hunton 1,793 ft., Viola 1,965 ft., Arbuckle 2,163 ft., show gas in Arbuckle.

Marion County

Lost Springs pool: Ritchey 1-B Hellach, NW NW NE 10-17-4, dry, T.D. 2,410 ft., Mississippi lime 2,342 ft.

Ring-Mac Oil 1 Dovak, NE NE 32-17-4, pumped and flowed 496 bbl., Mississippi lime 2,396-2,410 ft.

Wildcat: Rex & Morris 1 Kappan, N½ NW NE 16-18-4, dry, T.D. 2,461 ft., Mississippi lime 2,409 ft.

Reno County

Zenith pool: Landon 3 Union Central, W½ NW SW 7-24-10w, pumped and flowed 1,595 bbl., Viola 3,721-30 ft., T.D. 3,767 ft.

Rice County

Bornholdt pool: Central Petroleum 1 Wright, E½ SE SE 13-20-6w, pumped 70 bbl., Mississippi lime 3,311-18 ft., T.D. 3,336 ft.

Geneseo pool: Continental 6-A Lansing, NE NW SW 25-18-8w, pumped 1,988 bbl., Arbuckle 3,169-3,229 ft.

Keesling pool: Bay Petroleum 2 Mitchell, E½ W½ SW 3-20-9w, pumped 539 bbl., Arbuckle 3,214-24 ft.

South Silica pool: Herndon Drilling 1 Lola, W½ SW SW 19-20-10w, pumped 236 bbl., Arbuckle 3,260-76 ft.

Wellman field: Ingling & Parker 1-A Fair, NE NE 28-21-9w, 8,497,000 cu. ft. gas, Misener 3,312-16 ft., T.D. 3,360 ft.

Russell County

Big Creek pool: Gulf 1 Rusch, W½ SW SW 29-14-14w, pumped 200 bbl., Arbuckle 3,194-98 ft.

Driscoll pool: Haynes & Anschutz 1 Driscoll, S½ NW SE 30-15-11w, lost hole and abandoned at 3,270 ft., Lansing 2,950 ft., Sooy 3,258 ft.

Gorham pool: Central Petroleum 1-A Foster, S½ SW NE 3-14-15w, pumped 692 bbl., Lansing 3,130-35 ft., T.D. 3,137 ft.

Hall-Gurney pool: Jones & Shelbourne 2 Rein, N½ SW SW 27-14-13w, pumped 1,130 bbl. in 8 hr., Lansing 2,873-84 ft., T.D. 2,887 ft.

Skelly 4 Phinney, S½ SE NW 30-14-13w, pumped 259 bbl., Lansing 2,863-2,951 ft.

Texon 4 Bunker Hill, S½ NE 26-14-13w, pumped 427 bbl., Lansing 2,874-2,898 ft., T.D. 2,905 ft.

Trapp pool: Isern et al 1-A Schultz, N½ NW NE 16-15-13w, pumped and flowed 627 bbl. in 8 hr., Lansing 3,048-63 ft.

Sinclair Prairie et al 3 Sellens, E½ NE SE 35-15-13w, dry, T.D. 3,380 ft., Sooy 3,345 ft., Arbuckle 3,365 ft.

Stafford County

Jordan pool: Cities Service 2 Stimatze, E½ NW SW 15-25-14w, pumped 2,910 bbl., Lansing 3,777-3,830 ft. and 3,786-94 ft., T.D. 3,802 ft.

Wildcat (Shaeffer pool): Landon et al 1 Shaeffer, W½ NW SW 3-21-13w, swabbed 200 bbl. oil in 5 hr., potential 1,175 bbl., Arbuckle 3,540-44½ ft., T.D. 3,552 ft.

Stafford pool: Stanolind 4-A Ferris, SE NW SE 15-24-11w, flowed 411 bbl., Viola 3,791-3,820 ft.

Stevens County

Hugoton field: Stevens County Gas 1 Smith, SW SW SE 25-31-39w, 25,600,000 cu. ft. gas, pay zone 2,405-2,565 ft., acid.

Stevens County Gas 1 Palmer, SE SE NE 34-31-39w, 13,900,000 cu. ft. gas, pay zone 2,374-2,573 ft., acid.

Sumner County

Wildcat: Benedum-Trees 1 Landwehr, E½ SE SE 17-32-1, dry, T.D. 4,200 ft., Kansas City lime 2,995 ft., Mississippi lime 3,594 ft., Simpson 4,055 ft., Arbuckle 4,127 ft.

KANSAS DRILLING REPORT

Barton County

Stearns 1 Popp ..... NE SE NW 15-16-14w
13-in. 585 ft., anhydrite 867 ft., drilling 900 ft.

Republic Natural Gas 1 Radenberg ..... W½ NW SE 8-17-11w
T.D. 3,332 ft., Arbuckle 3,318 ft., swabbed 8 bbl. oil an hr. for 24 hr., acid, pumped 18 bbl. in 24 hr., reacidized, pumped 2 bbl. an hr. for 9 hr., gravity 34.5, reacidized.

Derby 1 Heinz ..... W½ SW SW 10-18-11w
First report.

Fred Steckel 1-A fee ..... S½ SW NE 11-20-12w
T.D. 3,381 ft., Arbuckle, 930 ft. oil in hole in 15 days, 1,530 ft. oil in hole in 33 days.

Butler County

Rex & Morris 2 Matthews ..... NE SE NW 26-28-6e
10-in. 1,454 ft., drilling 1,540 ft.

Cowley County

Trees 1 Rhodes ..... NW SW SE 13-31-4e
Drilling 2,005 ft.

Aladdin 1 Westerfield ..... NE SW NW 3-32-8e
Drilling 525 ft., 15-in. 30 ft.

Douglas County

Meinholdt & Edwards 1 Stanley ..... NW NE NW 3-14-21e
6-in. 800 ft., underreaming 1,235 ft.

Elk County

McPherson 1-A Batesman ..... SE SW NW 24-28-11e
Drilling 300 ft.

Ellis County

Crow 1 Miller ..... S½ SW SW 17-13-17w
Topeka 3,194 ft., drilling 3,400 ft.

Ellsworth County

Pryor & Lockhart 1 Weisenthal ..... SW SE NE 30-15-10w
Drilling 3,240 ft.

Jefferson County

McCain & Sherrod 1 Green ..... SW SW NW 9-11-19e
Mississippi lime 1,535 ft., underreaming 6-in. 1,537 ft.

Kearney County

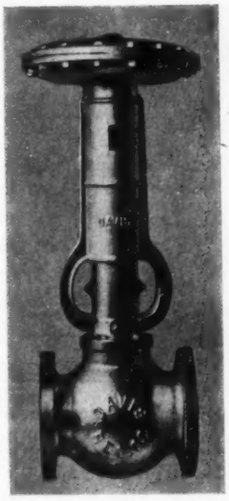
Stanolind 1 Billinger ..... E½ SE SW 15-21-38w
Anhydrite 2,168 ft., cored dense limestone 2,709-17½ ft., some show gas, drilling 2,830 ft.

McPherson County

Continental 1 Conrad ..... SE SW NE 31-19-5w
10-in. 167 ft.

(Continued on Page 229)

Flexible Control
with DAVIS DIAPHRAGM MOTOR VALVES



- FOR STEAM, AIR, GAS OR WATER LINES
- DIRECT OR REVERSE ACTING—INTERCHANGEABLE
- CONTROL BY LIQUID-LEVEL, PRESSURE OR TEMPERATURE
- PARABOLIC, SQUARE OR V-PORTED INNER VALVES.

SMOOTH operation, sensitive action and rugged, weather-proof construction will keep Davis Diaphragm Motor Valves on your list of thoroughly dependable control equipment. Standard valves are available in bronze, semi-steel, or steel, with trim of bronze, nickel-iron, monel or stainless steel. Special alloy steels for body and trim are available on order. If it's a motor valve application, specify DAVIS Complete details on request.

Write for Latest Catalog

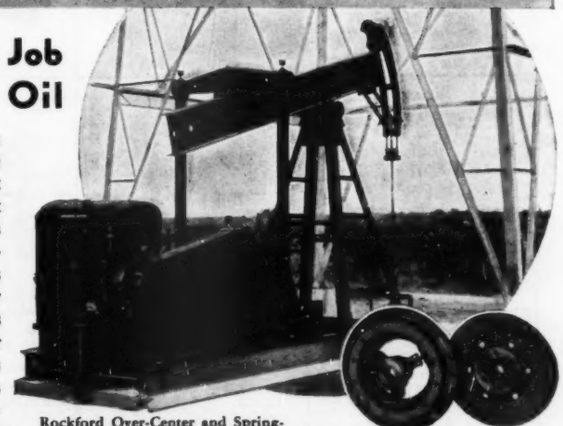
DAVIS REGULATOR COMPANY
2543 SOUTH WASHTENAW AVE. CHICAGO, ILL.

SOUTHWEST REPRESENTATIVE: Westcott & Greis, Inc., Tulsa, Dallas and Houston

Rockford Clutches

Stay Steadily On The Job In Getting Out The Oil

Running constantly, often in remote locations, pumping units require reliable performance in every part . . . the kind of performance that Rockford Clutches give. For this reason, you'll find Rockford Over-Center or Spring-Loaded Clutches controlling power delivery on many of the power units used in this service; and in a wide variety of other equipment, including leading makes of tractors. Rockford Plate Clutches are rugged, efficient, smooth-operating, notably durable in heavy-duty service. Specify Rockford Clutches when purchasing equipment and insure low-cost, reliable power transmission control.



Rockford Over-Center and Spring-Loaded Clutches are made in a complete range of standard sizes. Both types are available also in Rockford Power Take-Offs for standard S.A.E. flywheel housings. Equipment manufacturers are invited to use our free engineering service for developing applications.

Rockford Over-Center Clutch

Rockford Power Take-Off

Rockford Drilling Machine Division *Borg-Warner Corporation*
1305 Eighteenth Ave., Rockford, Illinois, U. S. A.

OVER-CENTER, SPRING-LOADED AND PULLMORE CLUTCHES

Active Leasing, Exploration Along Wilcox Trend

By
GEORGE WEBER

SHREVEPORT, La., Mar. 24.—Increased interest centered on the Summerville field of La Salle Parish, following oil discovery and further drilling. The Wilcox trend in general, extending from Grant Parish eastward to the Mississippi River, is the scene of active leasing and geophysical exploration. Up to the present time La Salle Parish has been the scene of most wildcatting, since all discoveries were made within its bounds, but activity is gaining in neighboring parishes.

Gas development continues to hold an important place in the tristate area. New completions in Panola and Shelby counties, East Texas, added to production, and new tests are scheduled for the Bethany field of Panola County, Texas, and a test in the newly discovered Greenwood shallow gas field is nearing the sand. Lisbon interest has declined since completion of the deep Smackover lime gas-condensate well, but further deep exploration on the large structure will be watched with interest. Development of the Joaquin field of Shelby County, Texas, and De Soto Parish, Louisiana, is continuing successfully, with completion of large potential producers by Southern Production Co., division of Southern Natural Gas Co., which will lay a pipe line to the company's distribution system source near the Monroe field, Northeast Louisiana.

Arkansas is primarily interested in gas at present. The focus of attention is the sour gas produced from several deep Smackover lime fields, particularly McKamie. The field, productive of a gas containing 4,500 grains of sulfur per 100 cu. ft. is classed as a gas field, with 160-acre spacing ruled for development. Recent completion of a well showing what is believed to be a mixture of oil and condensate, however, has brought uncertainty as to the field's productive possibilities. The well, Barnsdall 1 Cornelius, is producing from two horizons in the porous Smackover lime, the lower of which is possibly saturated with oil.

SUMMARY OF COMPLETIONS

	No.	Bbl.	Footage
North Louisiana			
Oil wells: Homer	1	1	1,433
Nebo	1	125	3,829
Olla	2	278	4,800
Dry holes: Urania	2	.....	2,821
Total	6	.....	12,983
Arkansas			
Oil wells: East El Dorado	1	30	2,829
Dry holes: Wildcats	3	.....	5,814
Total	4	.....	8,643
East Texas Border			
Gas wells: Carthage	1	*25	5,000
Joaquin	1	*30	5,105
Total	2	.....	10,105

*Million cu. ft.

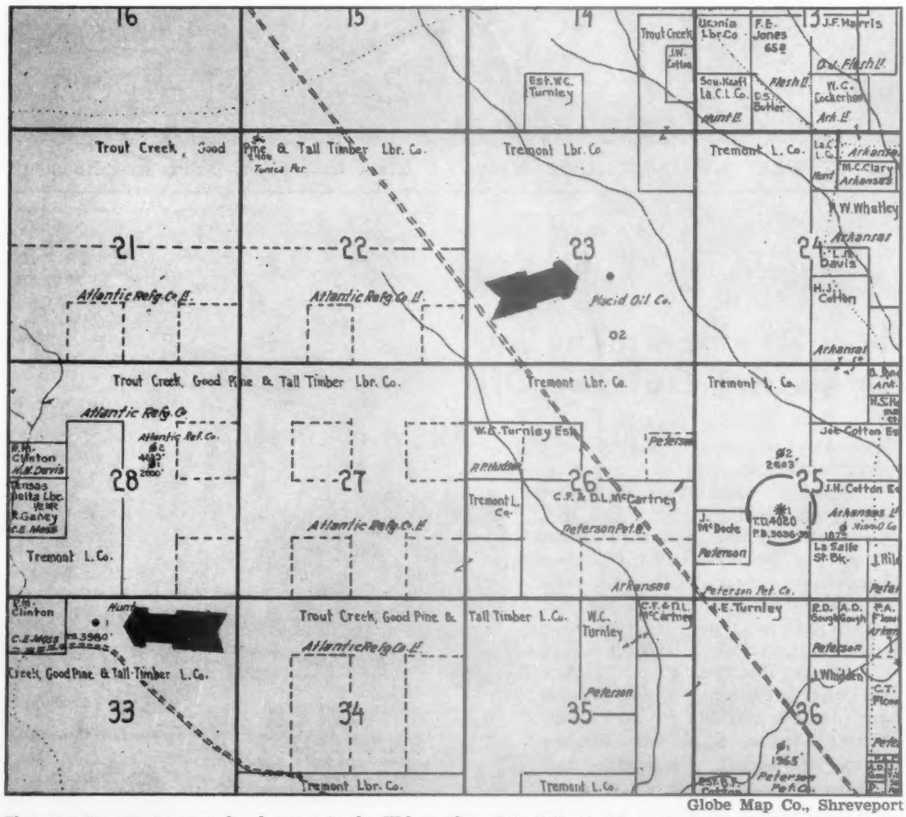
Wilcox Play

No developments of importance took place in the Wilcox area of North Louisiana during the past week. In La Salle Parish Big West Drilling Co. perforated 1 Whatley at 3,448-51 ft. and tested salt water. After squeezing and reperforating at 3,438-51 ft. the operators again recovered salt water and have squeezed the second series of perforations. The wildcat, located northwest of the Nebo field, has shown oil in a Sparta sand at 1,630-42 ft. and a Wilcox sand at 3,200-08 ft. Tests at those horizons will be watched with considerable interest.

The H. L. Hunt interests, including Hunt Oil Co. and Placid Oil Co. are the most active operators in the Wilcox trend, both from the standpoint of oil-field development and wildcat exploration. In the Summerville area, recently proven to oil production by Placid, two new locations of importance were staked this past week.

The Peterson Petroleum Co., which discovered the field last year, has staked 3 Tremont between the company's 1 Tremont gas well and the Placid oil discovery. Peterson acreage in the area erroneously reported to have been taken over by Hunt is still held by the Peterson company, which is again resuming drilling activity after drilling two tests. The first, Peterson 1 Tremont, opened gas production but the second was not completed as a commercial well. Both, however, showed gas and oil in the Wilcox.

Placid Oil Co. has staked a second test between the oil and gas wells, and has two operations to the west of the field. Its 1-B Goodpine, about 3 miles west of the Peterson gas well, is awaiting pump, after swabbing 20 bbl. of fluid, half oil and half salt water. About 1,500 ft. of fluid of the same oil content is standing in the hole. The company has staked 1 Doughty, about 1 mile southwest of the 1-B Goodpine. A total of six wildcats is actively drilling in the Wilcox trend, in Catahoula, Concordia, and La Salle parishes this week.



Globe Map Co., Shreveport

The most important recent development in the Wilcox play of La Salle Parish is discovery of oil in the Summerville area by Placid Oil Co. 1 Tremont. The field was discovered by Peterson Petroleum Corp. whose 1 Tremont was completed as a gas well in 25-9-2e. In addition o the oil discovery to the northwest, Placid 1-B Goodpine is showing oil and salt water 3 miles due west and is awaiting a pump for completion. Both Peterson and Placid have staked locations between the oil and gas wells

ARKANSAS

A deep test in the McKamie field of Lafayette County is of interest in the Smackover lime activity of South Arkansas. Atlantic Refining Co. was last reported drilling below 9,938 ft. in 3 Bodcaw. The test is being deepened below the producing porosity in the field in an effort to determine the character of the formation below the Reynolds oolitic member in the top. The test has encountered no shows of oil or gas below the main porous zone, and although some cores showed salty taste, this may be attributed to presence of connate water. To date, no bottom water has been located at McKamie as developed, and a water drive if present will be a lateral drive to the area now on production.

Another test was staked this week by the Turner, O'Farrell and Crow interests in the Stephens field, where a 3,700-ft. sand showed oil recently in 1 Smart, now heading oil and salt water.

NORTH LOUISIANA DRILLING REPORT

Bossier Parish

R. L. Reese 1-A Bellevue Land Co. SW NE SW 27-20-11 T.D. 3,007 ft., squeezed perf. 2,847-57 ft.

Catahoula Parish

H. L. Hunt 1 Southern Kraft.....SE SE 19-10-6e Drilling 3,682 ft.

Concordia Parish

K. Hughes 1 Nelson.....SE NW SE 34-9-10e Set 8⅝-in. casing 117 ft.

Wildcat—De Soto Parish

Schubert Oil Corp. 1 Scott.....SE NW SE 29-14-13 First report.

La Salle Parish

Big West Drlg. Co. 1 Whatley.....NE NE 25-8-2e Set 5½-in. casing 3,566 ft., perf. 3,448-51 ft., tested salt water, squeezed and perf. 3,438-51 ft., tested salt water, squeezed.

J. D. Critchett et al 1 Jones.....NW NW 41-7-3e Stuck 7-in. casing 2,700 ft., cemented 1,029 ft. 5½-in. casing at 3,600 ft., T.D. 3,963 ft.

Placid Oil Co. 1 Doughty.....NE SW 32-9-2e Set 10¾-in. casing 659 ft., drilling 3,293 ft.

Placid Oil Co. 1-B Goodpine.....NE NW 33-9-2e Swabbed est. 20 bbl. fluid, 50 per cent oil, 50 per cent salt water, 1,500 ft. same fluid in hole.

Wildcat—La Salle Parish

M. L. Meredith 1 Grey.....NE NE 36-8-2e
First report.

Lincoln Parish

Big West Drlg. Co. 1 Patton Est. E½ W½ SE 7-20-4w
Drilling anhydrite and shale 3,855 ft.
Herman Brown 1 Ark. La. Gas Co. SW NE 11-17 4
Drilling shale 8,675 ft.

Sabine Parish

Plummer & McDaniel 1 Phares NW NW SW 4-5-12
16-in. casing 70 ft., S.D.
Roy Raines 1 Carter.....SW NW NW 27-9-11
S.D. 2,403 ft.

NORTH LOUISIANA COMPLETIONS

Homer—Claiborne Parish

Louark Prod. Co. 40 Lowenberg.....SW SE 13-21-8
Pumped 34 bbl. water, slight show oil, T.D. 1,433 ft., 8-in. casing 1,418 ft.

Nebo—La Salle Parish

H. L. Hunt 15-A Goodpine.....NE NE 17-7-3e
250 bbl., 50 per cent salt water, 13/64-in. choke, T.P. 375 lb., C.P. 500 lb., 7-in. casing 3,630 ft., T.D. 3,857 ft., dry, perf. 3,362-68 ft.

Olla—La Salle Parish

Ark. Fuel Oil Co. 2-B Nugent.....NW SW 24-10-2e
168 bbl., 3 per cent salt water, 12/64-in. choke, T.P. 110 lb., C.P. 225 lb., perf. 2,229-34 ft., T.D. 2,365 ft., Cruse sand.
Placid Oil Co. 35 La. Central.....NW NW 31-10-3
140 bbl., 18 per cent salt water, 30/64-in. choke flow valves, T.P. 80 lb., C.P. 360 lb., 7-in. casing 2,429 ft., perf. 2,234-40 ft., lower Central sand, T.D. 2,435 ft.

Urania—La Salle Parish

La Salle Asso., Inc., 2 Tullos E½ W½ SW SE 23-10-1e
T.D. 1,238 ft., 6-in. casing 1,237 ft., salt water.
La Salle Asso., Inc., 2 Urania SE SE SW 19-10-2e
T.D. 1,583 ft., 5½-in. casing 1,581 ft., salt water.

ARKANSAS COMPLETIONS

Wildcat—Ouachita County

Frank J. Hughes 1 Rath & Cartier, Inc. .....
NE SW NE 35-13-18
T.D. 2,506 ft., salt water.

Wildcat—Sevier County

Gramp Oil Co. 2 F. Phillips.....SW SW SW 26-9-20
T.D. 1,043 ft., dry, 5-in. casing 953 ft.

Wildcat—St. Francis County

U. S. Oil Corp. 1 Wilford.....NE SE NE 29-4n-1w
T.D. 2,265 ft., dry, 7-in. casing 2,261 ft.

East El Dorado—Union County

Kinard Curtis et al 1 W. L. Rowland .....
SW SE NE 15-17-14
Pumped 30 bbl. oil, 1,200 bbl. salt water, T.D. 2,829 ft., 6⅝-in. casing 2,826 ft.

ARKANSAS DRILLING REPORT

Clark County

Coker, Christman & Grieves 1 Williams.....
NE NE NE 7-11-20
Moving in rig.
Christman, Coker & Grieves 1 Sparkman.....
NW NE NE 11-11-20
First report.

Columbia County

McAlester Fuel Co. 1 Franks.....SE SE 16-18-21
First report.

Faulkner County

Cato Oil Co. 1 R. R. Harrell.....SE SW 35-4n-12w
Drilling hard black shale 3,525 ft.

Lonoke County

A. V. Riley 1 J. T. Gunter.....SE SE 17-5n-10w
S.D. 2,808 ft.

Miller County

Louark Prod. Co. 1 E. J. Hedrick et al.....
SE NE 27-19s-27w
Drilling lime and shale 6,168 ft.
K. E. Jennings and J. J. Oil Corp. 1 H. T. Wood.
NE NE 33-18-28
Old well drilling deeper, first report.

Prairie County

Alvin E. Stark 1 Fidelity Mutual..NE NE SW 16-2n-6w
Drilling black shale 809 ft.

Union County

C. H. Murphy 1-C Cates.....NW SW 35-18-15
Perf. 6,025-27 ft., D.S. test, packer at 6,025 ft., recovered 3,100 ft. oil cut with drilling mud and 1,200 ft. salt water, squeezed and perf. 5,862-65 ft., tested salt water.

EAST TEXAS BORDER COMPLETIONS

Carthage—Panola County

Panola Dev. Co. 2 Bird, Gillespie Sur., 25,000,000 cu. ft. gas, open flow, T.D. 5,000 ft., perf. 4,662-74 ft.

Joaquin—Shelby County

Paul Pewitt 1 J. S. Swann, Ann Gray Sur., est. 30,000,000 cu. ft. gas, open flow, T.D. 5,105 ft., P.B. and perf. 4,978-90 ft., 5½-in. casing 5,105 ft.

EAST TEXAS BORDER DRILLING REPORT

Marion County

D. L. Butler et al 1 W. G. Bailey, Robert Maxwell Sur., S.D. 3,505 ft.
A. J. Vestal et al 1 C. Moseley, David Lane Sur., rig, S.D.
P. L. Withers et al 1 T. G. Allen, Robert Potter Sur., S.D. 2,366 ft.

Sabine County

Sturm & Womack 1-A Keith, L. Grace Sur., drilling 4,832 ft., lime and shale.

San Augustine County

B. F. Findley et al 1 G. W. Allen, A. N. Davis Sur., S.D. 450 ft.
Roper & Todd 1 Long Bell Lbr. Co., N. Hyden Sur., S.D. 793 ft., moving in new rig.

Shelby County

Cougar Oil Co. 1 Jones, John Latham Sur., S.D. 2,509 ft.

AVERAGE DAILY PRODUCTION

NORTH LOUISIANA

	Mar. 22	Mar. 15
Caddo, light	6,200	6,220
Caddo, heavy	2,060	2,050
Cotton Valley	13,595	13,600
Cross Lake	3,005	3,010
De Soto and Red River	995	1,000
Haynesville	2,560	2,575
Homer	2,800	2,805
Lisbon	2,850	2,845
Nebo	1,340	1,235
Olla	10,350	10,160
Rodessa	15,735	15,245
Sligo	2,295	2,465
Sugar Creek	1,265	1,275
Urania	2,265	2,270
Zwolle	1,225	1,230
Total North Louisiana	70,520	69,020
Rodessa, Texas	15,285	15,380

SOUTH ARKANSAS

Atlanta	2,625	2,525
Buckner	2,305	2,275
Champagnolle	1,125	1,130
Dorcheat	1,700	1,700
El Dorado	1,570	1,560
Magnolia	19,700	19,550
McKamie	1,600	1,500
Nick Springs	1,275	1,200
Rodessa	1,610	1,635
Schuler	16,400	16,500
Smackover, light	1,725	1,730
Smackover, heavy	13,460	13,445
Troy	1,070	1,085
Urbana	1,650	1,650
Village	1,065	1,065
Total South Arkansas	71,210	70,805

MISSISSIPPI

Tinsley	17,780	19,705
Pickens	655	785
Total Mississippi	18,435	20,590

Kansas Fields

(Continued from Page 227)

Nemaha County

Bumpus et al 1 Achten.....S½ SE NW 12-4-14e
Bartlesville zone 1,775-1,810 ft., 6-in. 2,185 ft., drilling 2,187 ft.

Pratt County

Reeves 1 Stark .....W½ SW NW 18-28-11w
10-in. 269 ft.

Reno County

Hess 1 McKee .....E½ NE SE 8-22-8w
6-in. 2,780 ft., underreaming 2,865 ft.

Rice County

Earl Wakefield 1 Smyres .....N½ NE SE 35-19-6w
Drilling 3,313 ft., show oil.
Sharon 1 Nevious .....SW SW NE 21-19-10w
T.D. 3,298 ft., shot 3,032-40 ft., pay 3,040½-42 ft., acid, pumped 176 bbl. oil in 8 hr., acid, potential 530 bbl.

Rooks County

Kerlyn and Phillips 1 Francis....W½ NW SE 31-9-17w
First report.
Ruso 1 Dick .....S½ NW SW 21-10-19w
Lansing 3,431 ft., Sooy 3,702 ft., Simpson 3,782 ft., Arbuckle 3,823-24 ft.

Russell County

Continental 1 F. Sibrava .....NE SW NE 34-13-13w
10-in. 441 ft., drilling 2,035 ft.
Earl Wakefield 1-A Cook .....E½ SE NE 26-13-15w
First report.
Central Petroleum 1 Zeman.....SW SW NE 16-15-12w
Dodge 2,901 ft., 1¼ bbl. water 2,910-15 ft., 6-in. 2,961 ft., Lansing 2,965 ft., ½ bbl. oil an hr 2,985-89 ft., some show oil 3,050-54 ft., ½ bbl. oil an hr 3,065-70 ft., hole full of water 3,078-3,100 ft., underreaming 3,134 ft.

Stafford County

Stanolind 1 Nagel .....E½ NE SW 3-24-15w
Lansing 3,632 ft., cored limestone 3,810-15 ft. with 3-in. at top showing oil, saturation 3,830-36 ft., Viola 3,966 ft., drilling 4,016 ft.

Thomas County

Alva Billings 1 Ryan .....E½ NE SE 27-8-32w
6-in. 4,013 ft., some show oil 4,120 ft., cleaning out 4,200 ft.

Woodson County

Phillips 1 Fidelity .....SW NW NE 4-26-15e
Drilling 1,500 ft.

FOREST CITY BASIN

ST. JOSEPH, Mo., Mar. 24.—After a long season of mud, the Forest City basin is experiencing an awakening. Oil men are on the move again in southeastern Nebraska, tending this time to cluster around the Shubert area of Richardson County.

Garetson & Knisely have what appears to be the fourth well in the Shubert area and No. 38 for the county. It is their No. 1 Bankers Life, which ran higher than the Black Gold Operating Co. 1 Smith, which it offsets to the north. In 1 Bankers Life a foot of lime was recovered in coring, there being saturation in the bottom. A mile east the Indian Territory Illuminating Oil Co. has two wells.

Trans-Atlantic Petroleum Co. made locations for 1 Frank Hebenstreit in NW SW 8-2n-16e, Richardson County, 5¾ miles southeast of Shubert. Johnson & Mitchell are moving in at 2 Eickhoff in C NW NW 4-2n-16e, west offset to 1 Eickhoff, which was a dry hole last fall, but which had oil shows. National Petroleum Co. 1 Lillian Oswald was started in C NW SW 15-2n-14e, a quarter mile west of Dawson in Richardson County.

Missouri also was noticing the pickup. Brin and Nathan 1 Decker, which was started in 1939 east of Mound City, is to be completed. Garetson & Knisely are moving in a slim-hole rotary. R. L. Campbell dug pits in Ray County for an Arbuckle test at 1 Rust, NW NW 21-53n-26n, 10 miles northeast of Richmond. A rotary is on the way from Nebraska. Robert Wells & Sons of Richmond, Mo., moved down from Caldwell County to Ray County and started drilling 1 Hoover, C SW NW 9-54n-28w.

FOREST CITY BASIN DRILLING REPORT

NEBRASKA

Richardson County

Ohio 2 Boice.....SE NE 18-1n-16e
Hunton lime 2,314 ft., T.D. 2,320 ft., drilled plug but delayed test.
Ohio 4 Bucholz.....C SW NW 17-1n-16e
Hunton 2,300 ft., T.D. 2,303 ft., cemented for test.
Ohio 1 Anne Gerhardt.....SW SE SE 7-1n-16e
Drilling 680 ft.
Black Gold 1 Smith.....C NW NW 31-3n-16e
Hunton 2,513 ft., T.D. 2,539 ft., oil rose 8 to 10 bbl. per hour, 30 per cent water; pump muddied in test, cleaning out.
Garetson & Knisely 1 Bankers Life..SW SW 30-3n-16e
Hunton 2,515 ft., cored 2,517-21 ft., saturation in bottom of 1 ft. of tight lime recovered, cemented for test.
I. T. I. O. 1 Mary Schaible.....C SW SW 29-3n-16e
Hunton 2,462 ft., T.D. 2,476½ ft., swabbed 15 bbl. an hr. after acid, pumped 139 bbl. fluid in 48 hr., 10-15 per cent water.
National Petroleum 1 Oswald.....C NW SW 15-2n-14e
Drilling 780 ft.
J. E. Palensky 1 Kalous.....SW SW 5-2n-13e
Hunton 895 ft., Viola 1,571 ft., St. Peter sand 1,853 ft.

MISSOURI

Ray County

Robert Wells & Sons 1 Hoover...C SW NW 9-54n-28w
Drilling.

Platte County

Missouri Valley Gas & Oil 1 Peret.....
C NW NW 12-51n-34w
S.D. 615 ft.

KANSAS

Brown County

Gernon et al 1 Bruce.....C E½ SE SE 15-3s-15e
Drilling 150 ft.

Oklahoma Fields

(Continued from Page 222)

5,820-70 ft., dry, second Wilcox 5,900 ft., cored dry Wilcox 5,812-21 ft., electric log showed slight kick in Viola section.

Osage County

Norbla & Champlin 1 Osage .....SW SW SW 23-25-6
Drilling 400 ft.
Black Jack Oil 1 Osage .....NE NE SW 29-25-7
Spud 50 ft.
Dillard 1 Osage .....SE NW NW 22-21-9
Drilling 600 ft.
Superior Oil 1 Osage .....NW SE SW 23-22-8
Pink limestone 2,254-62 ft., some show oil 2,382-90 ft., Bartlesville 2,457-68 ft., dry, Mississippi chert 2,620 ft., show oil 2,625-31 ft., drilling lime 2,662 ft.

Pawnee County

Dave Malernee 1 Lucas .....NW SE NW 28-21-8
Some show oil in broken sand 1,868 ft., drilling 2,436 ft. limestone.
Harwell & Burroughs 1 Isaacs....NW SW SE 25-20-6
First report, 12-in. 55 ft.

Payne County

Crosbie 1 Hogle ..... SE SE SW 29-20-2e
Drilling 1,540 ft., 10-in. 200 ft.

Seminole County

Blackwell 1 Boren .....SW SE SW 34-6-6
Cromwell 2,130-6 ft., no show, Caney 2,480 ft., Woodford 2,775 ft., Hunton 3,045 ft., Sylvan 3,128 ft., Viola 3,247 ft., Dense 3,340 ft., dolomite 3,381 ft., drilling 3,520 ft.
Mico 1 B. F. Davis .....NE NE NE 33-10-8
Cromwell 3,503 ft., cored dark shale and limy sand with slight stain 3,506-12 ft., cored stained limy sand 3,512-22 ft., 5-in. 3,488 ft.
Brayn 1 Wisey .....NE SE SE 5-11-8
Checkerboard 1,265 ft., Calvin 2,160 ft., Senora sand 2,512-21 ft., Booch 3,397 ft., Cromwell zone 3,645 ft., Cromwell sand 3,648 ft., cored fine dry sand, some well-stained coarse sand 3,648-58 ft., drilling ahead.
McIntyre 1 Brown .....SW SE NE 14-9-7
T.D. 4,295 ft., Hunton 4,080-4,106 ft., reacidized, swabbed 240 bbl. fluid in 4 hr., building separator and treating tanks.

Stephens County

Gulf 1 Krieger .....E½ NE SW 3-2-5w
Drilling 6,164 ft. sandy shale.
Haliburton 1 fee .....SE SW SW 5-1s-7w
Drilling 990 ft. shale.
Skelly 1 Frensley .....NE NE 35-1s-5w
Electric log 4,416 ft., drilling brown lime 4,910 ft.
H. J. Brown 1 Hewery .....NW SW NW 8-3s-5w
First report.

By
STAFF CORRESPONDENT

Two New Pools and New Sand Keep White Co. in Limelight

MATTOON, Ill., Mar. 24.—White County held the interest of Illinois oil operators last week as the activity of the state as a whole declined sharply. Benedum-Trees 1 Stinson, SW SW NE 19-7s-11e, which 2 weeks ago opened a new pool about 8 miles east of Carmi, swabbed 116 bbl. of oil in 6 hours in its most recent test. Operators last week reported that they were still cleaning out gravel and from all indications the well will produce at an even better rate on completion test. The Stinson well, about 6 miles from nearest production, is producing from the Tar Springs at a total depth of 2,129 ft. Although the discovery well has not yet been completed, two offsets, Benedum-Trees 2 Stinson, and Lupher 1 Vail are drilling and the location for a third offset has been announced.

Most recent pool opener in Illinois, Kingwood and Sinclair 1 H. M. Porter, NE SW SW 12-7s-8e, White County, is a small Cypress sand pumper, producing from saturation encountered at 2,612-25 ft. A representative of the company reported production for the well at about 36 bbl. a day.

The third development which helped keep White County the hot spot of Illinois activity was the addition of a new pay horizon to the South New Harmony field. W. C. McBride, Inc., 1 Hattie Golden tapped the McClosky lime in the first venture to explore that formation in the field and swabbed small amounts of oil before acid treatment at the end of the week. A production test will probably be completed early next week.

Benton pool.—A half-mile western extension of the Benton pool of Franklin County was anticipated with the recovery of saturation in the Tar Springs sand last week at J. W. Menhall 1 H. S. Stalcup, in 23-6s-2e. The saturation was recovered at 2,078 ft. The Benton pool has gradually increased in activity since its discovery and at the present time ranks among the most active in the state.

Trenton wells.—Three Trenton lime wells were completed in the Salem pool last week and 18 others were active. All three of the completions produced less than 200 bbl. a day initially. Two of the completions were made by the Texas Co. which at present has seven other tests under way and one was made by Magnolia which has nine other tests under way. The other tests were holdings of independent operators.

Wildcat Nears Completion

In Clinton County, about 8 miles west of the Centralia pool, the J. F. Ashoff 1 Lampen, in 16-1n-2w, was near completion last week in a test of saturation in the Cypress sand at 1,105-08 ft. It was unofficially reported that rods and tubing would be run in a few days. Operators have pulled all the outside casing that could be removed but there is some 10-in. still in the hole. Oil string was cemented inside the larger pipe preparatory to testing production. When the rods and tubing have been run the well will be put on pump for a production test.

SUMMARY OF COMPLETIONS

	No.	Bbl.	Footage
Oil wells: Louden	2	366	3,057
Mason	2	271	5,026
West Liberty	2	2,058	5,636
Dry holes: Fields*	1	.....	3,068
Wildcats	4	.....	8,660
Total	11	.....	25,447

*Clay City.

ILLINOIS COMPLETIONS

Clay County

Clay City pool: Pure 1 R. Bates-A, W½ NE SW 3-2n-8e, dry, Glen Dean 2,409 ft., Hardinsburg 2,423 ft., Barlow 2,563 ft., Cypress 2,578 ft., sand 2,606-14 ft., show oil, Ste. Genevieve 2,915 ft., Rosiclare 2,938 ft., Fredonia 2,964 ft., T.D. 3,068 ft.

Wildcat: Bradshaw Drlg. 1 Crews estate, NE NE NW 9-4n-5e, dry, slight show oil 2,643-48 ft., D.S. test 2,636-50 ft., received 30 ft. mud and 50 ft. water, T.D. 2,750 ft.

Douglas County

Wildcat: Pogue et al 1 Owens, NW SW NW 26-15n-7e, dry, T.D. 815 ft.

Effingham County

Mason pool: Langenfeld & Williams 1 Davis, NW NW NE 22-6n-5e, pumped 135 bbl., 1,500 gal. acid, McClosky 2,507-17 ft., T.D. 2,517 ft.

Hammer et al 1 Rose, SE NE NW 22-6n-5e, pumped 136 bbl., 1,500 gal. acid, Fredonia 2,488 ft., T.D. 2,509 ft.

Fayette County

Louden pool: Carter 1 Buzzard, SE SW SW 35-9n-3e, swabbed 150 bbl., 30-qt. shot 1,502-12 ft., Weller 1,494-1,529 ft., T.D. 1,529 ft.

Carter 1 J. B. Giles, SE SW NE 1-8n-3e, swabbed 216 bbl., 15-qt. shot 1,519-24 ft., Weller 1,512-28 ft., T.D. 1,528 ft.

Wildcat: P. Hollman 1 Kruse, NE SW NW 36-5n-2e, dry, Rosiclare 2,108 ft., Fredonia 2,135 ft., McClosky 2,140 ft., St. Louis 2,186 ft., T.D. 2,193 ft.

Jasper County

West Liberty pool: Pure 2 Frohning, W½ NW SW 33-6n-10e, flowed 937 bbl., 5,000 gal. acid, pay 2,805-10 ft., Fredonia 2,796 ft., T.D. 2,828 ft.

Pure 3 G. E. Adams, E½ NW NE 20-5n-10e, flowed 1,121 bbl., 5,000 gal. acid, pay 2,797-2,806 ft., Fredonia 2,795 ft., T.D. 2,808 ft.

Wildcat: Carl Buerkle et al 1 Payne, SE NE NE 6-5n-10e, dry, T.D. 2,902 ft.

ILLINOIS DRILLING REPORT

Adams County

C. Schachtsick 1 J. Richart ...NE SW NW 12-2s-8w
Drilling 70 ft., first report.

Bond County

Woodruff 1 Harwood .....NE NE SE 36-7n-4w
Drilling 797 ft.

Clay County

R. E. Hanon 1 Newton .....SE SE SW SE 18-3n-5e
Location, first report.

Clinton County

Algona 1 Marshall .....SE SE SW 12-1n-1w
Drilling 2,950 ft.

B. E. Martin 1 C. Heinzman.....SE SE SE 4-2n-1w
Drilling 320 ft.

Wilson 1 Lippert .....NE NE NE 27-2n-1w
S.D. 614 ft.

P. Mosebach 1 Schlarmann .....NE NW NW 9-1n-3w
Cypress 1,008 ft., Ste. Genevieve 1,285 ft., Devonian 2,402 ft., cored 2,402-20 ft., received slightly saturated lime, cored 2,420-37 ft., received saturated lime, drilling 3,840 ft.

J. F. Ashoff 1 Lampen ..... NW NW NW 16-1n-2w
T.D. 1,708 ft., filled 600 ft. fluid, cementing casing 1,700 ft.

Hughes 2 Holman .....NE SW SE 10-2r.-1w
Drilling 1,140 ft.

B. E. Martin 1 Brinkmann .. SW SW SW SE 9-1n-2w
Drilling 100 ft., first report.

Crawford County

Cullins 1 M. S. Davis .....NE SW NE 23-7n-13w
Rig.

Cullins 1 Kirtland .....NE NW 7-6n-13w
Rig.

Edgar County

Levy et al 1 Crockroft.....SW SE SE 11-12n-11w
Moving in machine.

Fayette County

J. T. Elmore 1 Keith.....SE NE NW 18-6n-1w
S.D. 315 ft.

Turner Drlg. 1 Williams .....SW SW NW 6-6n-2e
T.D. 584 ft., to ream.

H. R. Spires 1 Braasch .....NE NE SW 1-5n-2e.
S.D. 125 ft.

Ford County

Nelson et al 1 Erp .....SW NW SE 19-24n-7e
Drilling 2,682 ft.

Franklin County

W. O. Morgan 1 J. P. Miner .... NW NW NE 36-6s-2e
Set 10-in. 54 ft., drilling 630 ft.

Langenfeld & Williams 1 Plumlee W½ SW NW 21-6s-1e
Drilling 2,686 ft.

Gallatin County

R. Halbert 1 Curry .....SW SW NW 15-8s-10e
S.D. 610 ft.

Hamilton County

Cameron 1 Griffith .....SW SW SE 31-5s-7e
T.D. 3,165 ft., P.B. 2,964 ft., 1,500 ft. water and slight show oil, S.D.

Cameron Bros. 1 Hern .....NE SE SW 7-6s-7e
Location, first report.

E. S. Adkins 1 Federal Chem. & Coke Co. ..... NW NW SE 17-7s-6e
Rig, first report.

Jasper County

Pure 1 A. A. Cunningham ....W½ SW SE 16-6n-10e
Rig, first report.

Jefferson County

Obering 1 Morgan .....NW SE SW 25-2s-1e
T.D. 2,019 ft., drilled plug to 2,004 ft., S.D.

La Salle County

O. L. Greer 1 Sam Davis estate. SW SW SW 23-35n-2e
First report, moving in machine.

Lawrence County

W. Payne 1 H. Payne.....NW SW NW 20-3n-11w
Drilling 1,270 ft.

Marion County

Romine 2 Barbee ..... SW SE SW NE 33-3n-2e
Set 10-in. 120 ft., drilling 2,460 ft.

Morgan County

Measely et al 1 Thompson ... NW NE NW 1-16n-11w
Set 6-in. 920 ft., S.D. 1,090 ft.

C. L. Hunt 2 Cuddy ..... NE NW NW 2-13n-10w
Set 5-in. 1,408 ft., H.F.W., S.D. 1,422 ft.

Randolph County

J. R. Hankin 1 B. Bierman.....SW SW SE 3-7s-5w
Drilling 850 ft.

Richland County

C. B. Hill et al 1 Wood ..... NE SE SE 21-2n-14w
T.D. 3,094 ft., P.B. 2,808 ft. (corrected), drilling plug.

Scott County

A. L. Bedwell 1 E. C. Adams....NW SE SW 27-13n-13w
First report.

Wabash County

Harvey & Lobre 1 Strine ... NW NE NW 13-1n-14w
Menard 2,057 ft., Waltersburg 2,125 ft., Vienna 2,202 ft., Glen Dean 2,324 ft., Hardinsburg 2,346 ft., Golconda 2,405 ft., Barlow 2,520 ft., Cypress sand 2,542 ft., Paint Creek sand 2,671 ft., Benoist 2,687 ft., Renault 2,724 ft., Aux Vases 2,741 ft., Ste. Genevieve 2,796 ft., McClosky 2,851-56 ft., 2,866-71 ft., St. Louis 2,973 ft., 15-min. D.S. test 2,846-53 ft., received 3 gal. mud and slight show oil, S.D. 2,993 ft.

Troop Hevle 1 Dager .....SE NE SW 31-2n-11w
T.D. 2,120 ft., drilled plug, tested water, S.D.

F. A. Farrell 1 J. W. Price estate . SW SE NE 14-1n-12w
S.D. 2,382 ft.

Wayne County

Carter 1 Harrison-St. Ledger .....SE NW 34-1s-9e
Set 10-in. 142 ft., drilling 1,746 ft.

Pure 1 T. R. Michels-A ..... W½ SW NW 25-2n-7e
Set 8⅝-in. 232 ft., drilling 2,029 ft.

White County

J. Meyers 1 Hon ..... NE SE SE 20-4s-14w
Set 10-in. 130 ft., drilling 1,300 ft.

Continental 1 Ackerman .....NE NW NE 25-5s-10e
Set 10-in. 245 ft., S.D. 1,500 ft.

C. B. Brehm et al 1 Paneroy....NE NE SE 4-6s-10e
Rig.

Hiawatha Oil (was Benedum-Trees) 1 Stinson ..... SW SW NE 19-7s-11e
Tar Springs sand 2,114-28 ft., 30-qt. shot 2,118-28 ft.,

(Continued on Page 239)

Texas Gulf Coast

(Continued from Page 220)

Montgomery County

Wildcat: O. C. Garvey 1 Charles Horn, dry, T.D. 8,018 ft.

Wharton County

Hillje field: Rancho Oil Co. 1 Orsak, gas well, T.D. 5,237 ft.

Withers field: Texas 72-B Pierce, gas well, perf. casing 5,237-52 ft., T.D. 5,445 ft.

Texas 91-C Pierce, 115 bbl., ½-in. choke, perf. casing 5,312-45 ft., T.D. 5,379 ft.

Wildcat: F. W. Michaux 1 Koehl, dry, T.D. 6,220 ft.

TEXAS GULF COAST DRILLING REPORT

Brazoria County

Pure 1 Greenameyer, Manor Lake area, J. E. B. Austin Sur., drilling shale 2,213 ft.

Stanolind 1 Vieman, W of Chenango field, William Parker Sur., 10¾-in. casing 1,906 ft., T.D. 2,000 ft., W.O.C.

Harris County

Sun 1 Foster Lumber Co., NE of Humble field, Amasa Turner Sur., drilling shale 8,137 ft.

Jefferson County

Stanolind 1 Kaufman Investment Co., E outpost West Beaumont field, H. Williams Sur., drilling shale 5,028 ft.

Matagorda County

Skelly 1 Yeagley, NE of Blessing field, H.&G.N. Sur. 2, drilling shale 3,615 ft.

Stanolind 1 Huebner, Bay City area, E. Hall Sur., drilling shale 10,304 ft.

Waller County

Humble 1 Loucks, 1 mile NW of Katy gas field, H.& T.C. Sur., Sec. 97, drilling shale 2,637 ft.

Wharton County

W. R. Davis 1 Hartman, Lake View area, I.&G.N. Sur., Sec. 10, derrick.

Texas Progress Oil Co., Inc., 1 Sedlack, W.C.R.R. Sur., Sec. 66, drilling sandy shale 4,578 ft.

Frio Sand Production Found Near Refugio Townsite

By F. L. SINGLETON

CORPUS CHRISTI, Tex., Mar. 24.—A new Frio sand discovery in Refugio County, testing of a wildcat in Jim Hogg County, and extensions to proven fields featured developments in the Southwest Texas district the past week.

Southern Minerals Corp. 1 R. H. Wood, a wildcat 3 miles southeast of the Refugio townsite, Refugio County, is reported to be flowing at the rate of 85 bbl. of oil and 215 bbl. of salt water per day while testing through a ¼-in. choke. Tubing pressure is 550 lb., and casing pressure 1,575 lb. Total depth is 5,908 ft. and the well is flowing from perforated casing at 5,900-03 ft. Whether the well will be killed and recompleted in an attempt to shut off the water was not announced. Location is in the Anastacio Reojas grant, on strike with the La Rosa, Refugio and Tomoconnor fields.

SUMMARY OF COMPLETIONS

	No.	Bbl.	Footage
Lower Gulf Coast			
Oil wells: Fields	9	3,132	55,570
Dry holes: Fields	1	.....	4,753
Total	10	.....	46,351
Laredo District			
Oil wells: Fields	12	1,224	40,195
Dry holes: Fields	4	.....	12,624
Wildcats	5	.....	19,126
Total	21	.....	71,945
San Antonio District			
Oil wells: Fields	1	150	2,620
Total	1	.....	2,620

CLARA DRISCOLL.—An increase in drilling activity in the Clara Driscoll and South Clara Driscoll fields is anticipated following the completion of Texas Conservative 2 Huie which practically joined production in both fields. Located approximately midway between the two fields, completion was made in sand topped at 5,615 ft., and on a 24-hour gage the well flowed 102 bbl. of 38-gravity oil through a 11/64-in. choke. Tubing pressure and casing pressure were 475 lb. Recent extensions and new sand discoveries in this area have brought about a revival of drilling activity, and for the next few weeks interest in the area will be centered on Texas Conservative 1 Schubert in Section 130, about 1 mile southeast of the South Clara Driscoll field, a projected 7,000-ft. test.

AGUA DULCE.—Main interest in the Agua Dulce field, Nueces County, is centered on the outcome of a scheduled production test at Ginther, Warren & Ginther 1 Eggert, an east outpost in Section 83, Paul subdivision. The well is bottomed at 7,502 ft., and 5½-in. casing was cemented at 6,950 ft. to test gas and distillate sands logged by an electrical survey at intervals from 6,888-6,900 ft. Another semiwildcat being watched with interest is Shasta Oil Co. 1 Von Blucher, located in the same area and about 3,850 ft. southeast of Gillespie 1 Dabney, completed at the close of last year as a distillate producer. The Shasta test is coring below 6,200 ft. with no shows of oil or gas reported. Another semiwildcat to this flank drilling campaign which has resulted from new sand discoveries along the east side of the Agua Dulce-Stratton fields, is J. V. Calvert 1 E. B. Coopwood, 3 miles south of the Agua Dulce townsite in the A. Longloria grant, a projected 6,500-ft. test.

ST. CHARLES BAY.—Humble 1-27 State, offshore from Aransas County in St. Charles Bay which showed promise of producing gas-distillate 2 weeks ago has been abandoned after the well failed to flow on two production tests at 7,438-48 ft. On a recent test the well flowed gas and a small amount of distillate from perforated casing at 7,840-50 ft. The rig is being moved to Aransas Bay for 1-246 State, about 4 miles northeast of Aransas Pass. Another marine operation recently started is Gulfboard 1-114 State, about 10 miles southwest of Seadrift in San Antonio Bay, Calhoun County.

EAST MATHIS.—The East Mathis field, San Patricio County, which has been inactive for several months gained a new operation as Tom Graham made preparations to drill 1 Otto Blumberg in Section 13, Paul subdivision. The location is about ½ mile northwest of Seaboard 1 Lovett, an oil well, and about ½ mile southwest of Seaboard 1 Blumberg, a gas-distillate producer.

ROBSTOWN.—Interest in the Robstown field, Nueces County, was being revived as Jay Simmons 1 Nauman was showing for a producer while testing through perforated casing at 5,650-55 ft. The well is flowing 50 per cent oil and 50 per cent wash water while testing through a 7/32-in. choke. Tubing pressure is 1,700 lb. and casing pressure 2,150 lb. Location is 1,250 ft. east of the discovery well.

Jim Hogg County Wildcat

Main interest in the Laredo district is held by Forest Development Co. 1 Ramirez, approximately 2 miles west of the Colorado field, Jim Hogg County, which has cemented 5½-in. casing at 2,135 ft., preparatory to testing the Mirando sand at intervals from 1,999-2,008 ft. The well was drilled to a total depth of 3,006 ft., and casing was cemented after an electrical survey and side-wall cores showed sand with favorable possibilities. Location is in the J. S. Williams Survey. Sun 1 McCampbell, located in the Las Vivoritas grant, is reported to have been abandoned at a total depth of 5,604 ft. following a 25-minute drill-stem test at 4,443-53 ft., which recovered drilling mud and water.

NICHOLS.—The producing area of the Nichols field, Hidalgo County, was enlarged with the completion of Royal Oil & Gas Co. 1 Missouri Pacific Railroad which flowed at the rate of 37 bbl. per day while testing through a 3/32-in. choke from perforated casing at 3,519-25 ft. The well is located several hundred feet south of production, and the rig is being moved to 1 Garcia Land & Livestock Co., located on the west edge of the field in Porcion 43, Reynosa jurisdiction.

BENAVIDES.—Gas-distillate production was extended about 2,000 ft. west in the Benavides field by the completion of Hiawatha Oil & Gas Co. 30 Parr which is flowing gas and distillate while testing through perforated casing in the Cockfield sand at 5,588-94 ft.

BRIDWELL.—In the Bridwell field, Forest Development Co. 3 Rogers, a northeast offset to 1 Rogers, is being completed after the well recovered pipe-line oil on a drill-stem test at 4,295-4,303 ft. Location is in the J. Poitevent Survey 258.

SUN.—An extension to the Sun field, Starr County, was indicated as Nueces Royalty Co. prepared to test 1 Sabas after three drill-stem tests showed promise of production. A 12-minute test at 4,556-66 ft. recovered 450 ft. of oil and tested 400 lb. working pressure, while a 15-minute test at 4,866-74 ft. tested 44 lb. working pressure and recovered 60 ft. of oily mud. The third test at 4,908-13 ft. recovered 100 ft. of oil, 110 ft. of salt water and tested 126 lb. working pressure. Total depth is 5,048 ft. Location is in Survey 241.

SOUTHWEST TEXAS COMPLETIONS
LOWER GULF COAST DISTRICT

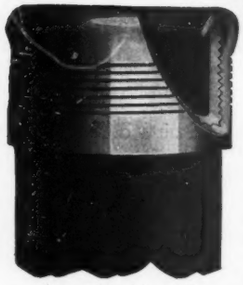
Nueces County

Agua Dulce field: C. P. Burton 1 Ingram, 225 bbl., ¼-in. choke, perf. casing 6,410-22 ft., T.D. 6,423 ft.
Richardson 5 McCoy, 75 bbl. oil and 300 bbl. salt water, gas lift, perf. casing 6,509-12 ft., T.D. 7,549 ft.
Shield 1 Schultz, 307 bbl., ¼-in. choke, perf. casing 6,492-6,506 ft., T.D. 6,528 ft.
Richard King field: Southern Minerals 6 Walker, 119 bbl., ¼-in. choke, perf. casing 5,637-42 ft., T.D. 5,652 ft.
Stratton field: Gulf Plains 2 Texon Royalty Co., 683 bbl. from upper sand, 1,366 bbl. from lower sand, perf. casing 6,132-49 ft., 6,172-6,205 ft., T.D. 6,462 ft.
Southern Minerals 7 Sellers, 92 bbl., ¼-in. choke, perf. casing 6,417-33 ft., T.D. 6,630 ft.

Zingery Map Co., Houston

Southern Minerals 1 Wood which opens a new Frio sand field in the Woodsboro area, Refugio County

Because of delays it pays to
PROTECT EACH ORDER
with WEDGE
THREAD PROTECTORS
that give you 4 Point Protection



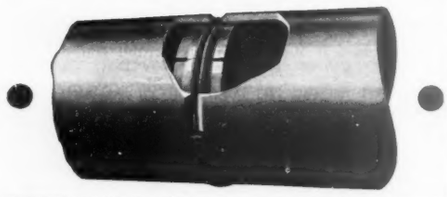
LOOK THEM OVER

1 CLEARS CREST OF THREAD
2 LOCKS INSIDE OF PIPE
3 CLEARS FIRST FEW THREADS
4 HAVE SMOOTH ROLLED THREADS

Patent No. 2,156,169

Since the Mills are constantly finding it more difficult to fill orders promptly, it is imperative that your pipe reaches you with undamaged threads. To replace damaged pipe may take a long time and hold up important work. It is therefore sound practice to specify WEDGE Thread Protectors on each pipe order and obtain the maximum 4-POINT PROTECTION that only WEDGE can give you.

Save MONEY



WEDGE Chill Rings reduce laying time and save money in several ways. You will use less welding material, eliminate icicles, speed aligning, and also obtain a perfect union. Your skilled help can lay the line FASTER with WEDGE Chill Rings.

Write for Prices and Specifications

WEDGE PROTECTORS, INC.
9520 Richmond Ave., Cleveland, Ohio

use WEDGE
Thread Protectors-Chill Rings

REGISTERED PROFESSIONAL ENGINEERS

Air • Gas • Water
REPRESSURING
RECYCLING • PRESSURE MAINTENANCE
INSTALLATION • OPERATION

PETROLEUM ENGINEER
JO H CABLE
WICHITA FALLS TEXAS

GAS MEASUREMENT • PERMEABILITY
COMPRESSOR PLANTS • POROSITY
BOTTOM HOLE PRESSURE • SATURATION
GAS OIL RATIOS • RECOVERABLE OIL
CONTROL OF FLOW THRU FORMATION

REGISTERED PROFESSIONAL ENGINEERS

Refugio County

Fagan field: Barnsdall 7 Marberry, 65 bbl., 6/64-in. choke, perf. casing 5,640-60 ft., T.D. 5,665 ft.
La Rosa field: Coronado Corp. 1-B Rooke, dry, T.D. 4,753 ft.

San Patricio County

East White Point field: Republic Natural Gas Co. 37 Rachal, 137 bbl., ⅛-in. choke, perf. casing 5,528-46 ft., T.D. 5,900 ft.

Victoria County

Placedo field: Ownby Drilling Co. 2 Marek, 63 bbl., 11/64-in. choke, sand 4,740-61 ft., T.D.

SOUTHWEST TEXAS DRILLING REPORT

Caldwell County

Wilcox Oil & Gas Co. 1 Walker, William J. Sneed Sur., drilling shale 1,620 ft.

Calhoun County

Gulfboard 1-177 State, San Antonio Bay, rigging up.
Moore & Ahern 1 Moore & McInnis, N of Seadrift, Miguel Castillo Sur., drilling shale and lime 4,150 ft.

Cameron County

Pure 4 Gatewood Newberry, SW of Point Isabel, T.D. 11,266 ft., prepare to abandon.

Dimmitt County

Diamond Halff Oil Co. 1 Kirk, SE of discovery well, Carrizo Springs field, coring 2,389 ft.
Humble 1 Catarina Farms, T.&N.O. Sur. 57, drilling shale 4,558 ft.

Duval County

Henderson Coquat 1 Garcia, SE of Sejita field, drilling shale 1,786 ft.
Sun 1 Black, James House Sur. 6, drilling shale 4,538 ft.
E. R. Thomas 1 Berrera, Thomas Lockhart Subd., J. Adams Sur. 4, drilling 310 ft.

Jim Hobb County

Achning & Daubert 1 Garza, Sur. 145, drilling shale 2,046 ft.
William F. Morgan 1 Lopez, B.S.&F. Sur. 124, dry, T.D. 3,116 ft.

La Salle County

Barnsdall 1 Sager, Sec. 903, spudded.

Lee County

Shell 1 Brown, Amasa Burchard Sur., dry, T.D. 6,050 ft.

McMullen County

Crown Central 1 Dolan, J. Kennedy Sur., S.D. 3,400 ft.

Starr County

Transwestern 1 Hope, N of Rincon field, Sur. 228, drilling shale 2,827 ft.

Victoria County

J. Newton Rayzor 1 Evertson, S. Simms Sur., drilling 510 ft.

LAREDO DISTRICT

Duval County

Bridwell field: Bridwell 5 Parr, 199 bbl., 7/64-in. choke, perf. casing 4,301-03 ft., T.D. 4,306 ft.
Cedro Hill field: Magnolia 25 Duval County Ranch Co., 52 bbl., jetting, sand 1,528-34 ft., T.D.
Cole field: H. W. Brewer 1 Harper, 10 bbl. oil and 50 bbl. salt water, pumping, T.D. 1,773 ft.
Hoffman field: Gilcrease 3-A Salazar, 44 bbl., ⅛-in. choke, perf. casing 2,628-29 ft., T.D. 2,635 ft.
Wildcats: H. B. Blanchard 1 E. A. Parr, dry, T.D. 4,400 ft.
George Proctor 2 Fredericks, dry, T.D. 1,503 ft.
Henderson Coquat 1 Delores Garcia, dry, T.D. 6,505 ft.
H. J. Mosser 1 Hoffman, dry, T.D. 3,015 ft.

Hidalgo County

San Salvador field: Gulf States 1 Cavazos, 140 bbl., adjustable chokes, perf. casing 7,910-20 ft., 7,325-45 ft., T.D. 8,004 ft.

Jim Hogg County

Kelsey field: Humble 2 Juarez, 86 bbl., ½-in. choke, gas lift, T.D. 4,754 ft.
Randado field: Achining & Daubert 1 Weil, dry, T.D. 2,871 ft.

Live Oak County

White Creek field: Alvin Brauer, 20 bbl., pumping, perf. casing 1,500-17 ft., T.D. 1,571 ft.

Starr County

North Rincon field: Arkansas Fuel 1 Martinez, dry, T.D. 5,800 ft.
Sun 3 Saenz, 64 bbl., 5/32-in. choke, perf. casing 4,374-83 ft., T.D. 4,395 ft.
Rincon field: Continental 1-D Davenport, 69 bbl. oil and 31 bbl. salt water, gas lift, perf. casing 4,000-20 ft., T.D. 4,689 ft.
Rio Grande City field: W. W. Zimmerman 1 Doyno, dry, T.D. 1,780 ft.
Wildcat: T. B. Hoffer 1 Hamilton, dry, T.D. 3,703 ft.

Webb County

Glen field: Buffalo 3-F Hinnant, dry, T.D. 2,173 ft.
Interstate Minerals 55 Lopez, 155 bbl., pumping, sand 2,147-63 ft., T.D.
Interstate Minerals 56 Lopez, 175 bbl., pumping, sand 2,181-86 ft., T.D.
Interstate Minerals 57 Lopez, 160 bbl., pumping, sand 2,178-85 ft., T.D.

SAN ANTONIO DISTRICT

Caldwell County

Tenney Creek field: Ellmag Oil Corp. 2-B Connelly, 150 bbl., 8 hr., ¼-in. choke, T.D. 2,620 ft.

Indiana Fields

(Continued from Page 216)

Cherry & Kidd et al 1 Packet Realty.....NW NE NW 2-4s-14w
T.D. 2,885 ft., 5½-in. 2,836 ft., waiting on cement.

Spencer County

J. B. Miller et al 1 Dooley.....NW NE NW 19-7s-7w
Drilling 140 ft.

Sullivan County

E. M. Self 1 James Land.....NE NE NE 36-7n-9w
Set 15-in. 45 ft., drilling 150 ft.
W. J. Reynolds 1 Hyde.....SW NE NE 9-8n-10w
Set 12-in. 31 ft., drilling 170 ft.
G. W. Boyce et al 1 Kelly.....SW SW NE 10-8n-11w
Spud, first report.
T. H. Drake 1 Curry.....NE SW 11-9n-8w
S.D. 95 ft.

Vanderburg County

C. J. Williams et al 1 Struek....SW SW NW 6-7s-11w
First report.
T. W. Drake 1 Nurrenbern.....SE NE NE 6-7s-14w
Drilling 1,002 ft.

Vigo County

Sage & Farley 1 Campbell.....S½ NE NW 24-11n-8w
Drilling 2,040 ft.

EASTERN KENTUCKY

ASHLAND, Ky., Mar. 24.—Completion of six gas wells with a combined production of 2,293,000 cu. ft. of gas and completed log in data on a 50-bbl. oil well make a midmonth drilling report available.

Interest in a Clark County deep test is seemingly "blacked out" with the report that the well, on the Chism farm, south of Ruckerville, has been plugged. W. C. Allen and W. W. McClure were the operators. Depth was not available.

The only definite deep test now under way in this area is the Cumberland Petroleum No. 64 on the L. C. Bailey tract near Oil Springs in Magoffin County. This well, already past the 4,350-ft. level, is being sponsored by other interested firms with "St. Peter" sand the objective.

Firms interested in gas wells are seemingly the active ones this month with a number of locations made and roads to proposed wells being rushed to completion despite the spring weather.

The Kentucky-West Virginia Gas Co.'s 1941 program calling for 90 gas wells plus a survey for a possible 200-mile pipe line from eastern Kentucky to northern West Virginia is responsible for much of this interest but other concerns are also becoming more active.

Completion of oil wells has been on the down grade in this area this year and so far the national-defense program has failed to create any noticeable drilling increase in the oil fields of this part of the state. Districts which showed quite a few completions several months ago now report "no operations."

EASTERN KENTUCKY COMPLETIONS

Floyd County

Warfield Gas Co. 4992 Elkhorn Coal Co., Big Branch, 267,000 cu. ft. gas, 2,763 ft. in shale.
Columbian Fuel 845-GW John K. Stratton, Stratton Branch, 133,000 cu. ft. gas, Corniferous, filled to 2,890 ft. and acidized.

Knott County

United Carbon 887 Kycoga Land Co., left fork Troublesome Creek 840,000 cu. ft. gas, 1,790 ft. in Maxon.
Hamilton Gas 20-E Anna Sparkman, Buckeye Branch, 84,000 cu. ft. gas, 2,833 ft. in shale, completed log in.

Martin County

Virginian Gas & Oil 1293-V W. H. Blankenship, Left Rockcastle, 50 bbl. oil, 1,112 ft., in Maxon, completed log in.

Pike County

United Carbon 886 Colony C. & C. Co., Island Creek, 850,000 cu. ft. gas, 3,065 ft. in shale.
Warfield Gas Co. 4898 A. C. Long et al, Russell Fork, 119,000 cu. ft. gas, 3,859 ft. in shale.

EASTERN KENTUCKY DRILLING OPERATIONS

Breathitt County

Miles et al 1 Davis Land Co., Lick Fork, abandoned.

Floyd County

Warfield 4986 Rhoda J. Roberts, Toler Creek, 2,163 ft., Big lime.
Warfield 4991 Elkhorn Coal Corp., Big Branch, 2,105 ft., Berea.
Warfield 4997 Maudie James No. 1, Twin Branch, 1,468 ft., Big lime.

Knott County

Inland 219 Sylvania Cornette, Big Branch of Troublesome Creek, 1,577 ft., Salt sand.
Inland 221, 3,362 ft., slate and shells.
Kentucky-W. Va. Gas Co. 5287 Ben Smith, 1,735 ft., black lime.

WESTERN KENTUCKY

Christian County

Bluff Springs district: F. C. Thomas 1 C. Tucker, dry at 434 ft.

Daviess County

Utica district: Creek Drilling Co. 10 Gus Morgan, 15 bbl., 60-qt. shot, Barlow sand 1,264-77 ft., T.D. 1,283 ft.

McLean County

Kirtley district: South Penn 1 B. J. Coke, dry through McClosky, T.D. 2,048 ft.
Glenville district: Ohio 2 G. B. McManama, Acct. 2, 15 bbl., acidized 4,000 gal., McClosky 1,678-83 ft., T.D. 1,723 ft., deepened from old T.D. 1,395 ft.
Ohio 1 G. B. McManama, Acct. 2, dry through McClosky, T.D. 1,751 ft., deepened from old T.D. 1,560 ft.
Cameron 1 J. F. Kerrick, drilling at 1,655 ft., old T.D. 1,461 ft.

By

R. MARNE SANFORD

Attempt to Extend Ordovician Play Into Reagan County

MIDLAND, Tex., Mar. 24.—The Ordovician exploratory campaign shifted eastward out of the southern Crane and northern Pecos area and into Reagan County. Amerada Petroleum Corp. has staked location for an 8,500-ft. Ordovician wildcat test just west of Barnhart and in the southeastern corner of the county. The Big Lake field, in Reagan County, had the first production in the Ordovician in West Texas.

Amerada's location is 1-R.A. University, 1,980 ft. from the north and 660 ft. from the east lines of Section 3, Block 48, University Lands Survey. Contracted to 8,500 ft., it will be drilled as a "tight" operation. The test is reported prepared to start at once.

In southern Crane County Gulf Oil Corp. is still testing its prospective new Ellenburger lime discovery on the Waddell ranch, Section 15, Block 3, H.&T.C. Survey. The wildcat, 17 Waddell, drilled saturation in the Ellenburger lime last week and cemented casing for completion attempts. Plug was drilled this week and tubing run to 5,642 ft. where the test was given an acid treatment with 2,000 gal. With hole standing full of liquid after acid treatment, it was swabbed down 4,100 ft. When oil load was recovered the well gaged 334 bbl. of oil in 14 hours, flowing through tubing and casing on gas lift. The oil tested 36.8 gravity and gas was estimated at the rate of 1,000,000 cu. ft. daily. The hole is bottomed at 5,648 ft. and operators were preparing to rerun tubing and treat the pay again, this time with 5,000 gal. of acid.

SUMMARY OF COMPLETIONS

Southern West Texas

Oil: Johnson	3	1,125	12,792
North Cowden	2	530	8,730
White & Baker	2	163	3,802
Others	5	1,200	10,844
Dry: Wildcats	1	.....	3,373
Total	13	.....	39,541

Northern West Texas

	No.	Bbl.	Footage
Oil: Slaughter	11	9,544	55,150
Wasson	3	3,146	15,548
Sharon	2	365	4,915
Dockery-Robbins	1	332	1,790
Total	17	.....	77,403

Panhandle

Oil wells: Carson County	2	468	6,129
Gray County	3	692	9,393
Hutchinson County	5	1,021	15,040
Total	10	.....	30,562

Southeast New Mexico

	No.	Bbl.	Footage
Oil wells: Fields	3	165	7,754
Dry holes: Fields	1	.....	4,005
Wildcats	1	.....	1,000
Total	5	.....	12,759

Abell Field Deeper Discovery

A ¾-mile northwest extension was recorded in the Abell field of northern Pecos County by a test which found oil at a level considerably lower than in the other wells in the field. The test is Magnolia 1 State-Sharp, SE cor. Section 22, Block 9, H.&G.N. Survey, ⅞ mile northwest of the company's 1 State-Baldwin, a large producer. The State-Sharp test was barren in the upper Simpson lime pay of the field and in deepening found saturation from 5,932-35 ft. with broken sand to 5,945 ft., total depth. At the close of the week the well made 25 bbl. of oil in 6 hours, swabbing, with casing pressure registered at 200 lb. The pay is in the lower part of the Simpson section but is the same general horizon as found in other wells in the field.

A new 4,000-ft. wildcat location 10 miles northwest of Fort Stockton in Pecos County has been staked by Phillips Petroleum Co. It is to be 1 H. R. Price, 660 ft. from the south and 1,980 ft. from the east lines of Section 6, Block 106, Texas & St. Louis Railway Co. Survey. It is 4 miles northeast of the Pryor-Courtney short-lived producing area that was opened by Phillips and later acquired by Cardinal Oil Co. Materials are being moved to the site of the new test and it will start at once. The contract depth is not expected to carry it to the Ordovician levels, however, should production fail in 4,000 ft. it would be considered for deepening.

Ector County Strike

A new pool for northern Ector County, 3 miles north of the Goldsmith field, has been opened by Phillips 3 Embar (formerly 1-124 Embar), located in Section 9, Block 44, Township 1n, T.&P. Survey. The test is 1½ miles southeast of the same firm's 1-A Embar, completed recently for 34 bbl. of oil and 3 bbl. of water daily to open a new producing spot. No. 3 Embar topped the pay at 4,204 ft. and is bottomed at 4,279 ft., the section having been treated with 1,000 gal. of acid. Latest gage was 24 bbl. flowing in 8 hours through 11/64-in. choke. Previously the well had flowed 94 bbl. in 15 hours through open tubing. It is shut in for the erection of storage.

SOUTHERN WEST TEXAS COMPLETIONS

(24-hour ratings based on last 3 hours of 6-hour gage)

Ector County

Johnson field: Continental 6-B Johnson, 448 bbl., open tubing, 500-qt. shot, 4,150-4,312 ft.
Lee Drilling Co. 13 Johnson, 164 bbl., open tubing, 320-qt. shot, 4,260-4,330 ft.
George P. Livermore 2-35 Johnson, 513 bbl., ⅝-in. choke, 165-qt. shot, 4,100-54 ft.
North Cowden field: Texas 5 Holt, 179 bbl., pumping, with 9 bbl. water, 680-qt. shot, 4,305-4,430 ft.
Forest Development 5 Moss, 351 bbl., open tubing, 450-qt. shot, 4,130-4,300 ft.
Eastland Oil 1 University, abandoned location.

Pecos County

Taylor-Link field: D. Breedi[illegible] 7-J University, 85 bbl. oil with 42 bbl. water, [illegible]umping, 3,000 gal. acid, 1,615-91 ft.
White & Baker field: Cardinal Oil 3-A-45 White & Baker, 45 bbl., open tubing, 110-qt. shot, 1,652-1,715 ft.
J. M. Odam 2 White & Baker, 118 bbl., 34/64-in. choke, 45-qt. shot, 2,045-87 ft.
Tobarg field: Stanolind 7-B Smith, 89 bbl., pumping, natural, 406-10 ft.

Ward County

Ward field: Acme Oil & Royalty 4 Shell-Sloan, 255 bbl., pumping, natural, 2,512-3,034 ft.

Winkler County

Estes field: Gulf 75 Daugherty, 265 bbl., open casing, 420-qt. shot, 2,820-2,936 ft.
O'Brien field: Gulf 158 O'Brien, 506 bbl., open casing, 500-qt. shot, 2,609-2,773 ft.
Wildcat: Stanolind and Westbrook 1 American Maracaibo, NW NW Sec. 19, Blk. 26, P.S.L. Sur., junked and abandoned at 3,373 ft.

SOUTHERN WEST TEXAS WILDCAT REPORT

Crane County

Gulf 1-F University, SE SE Sec. 22, Blk. 31, University Sur., top Simpson 9,600 ft., drilling 10,140 ft.
Gulf 17 Waddell, Sec. 13, Blk. 3, H.&T.C. Sur., 4 mi. S of Sand Hills field, drilled saturation 5,601-48 ft., tested 6,000,000 cu. ft. gas and show oil, top Detrital 5,538 ft., top Ellenburger 5,584 ft., flowed 334 bbl. oil in 14 hr., T.D. 5,548 ft.
Eastham & Russell 1 McClintic, NE SE Sec. 210, Blk. F, C.C.S.D.&R.G.N.G. Sur., 7-in. 2,517 ft., 5½-in. 2,870 ft., T.D.

Crockett County

George T. Morris 1 Brock Hoover, SW SE Sec. 99, Blk. 1, I.&G.N. Sur., 2,000-ft. test, S.D. 1,037 ft.

Ector County

Cities Service 1 F. V. Addis, SW SE Sec. 34, Blk. 43, Twp. 2s, T.&P. Sur., drilled in new hole to 5,500 ft., P.B. 4,210 ft., bailing hole.
Forest Development Co. 1-C Edwards, SE SE SW Sec. 20, Blk. 43, Twp. 3s, T.&P. Sur., top anhydrite 1,760 ft., fishing 2,378 ft.

Pecos County

Culbertson & Irwin 1 R. G. Heiner, NE NE Sec. 589, G.C.S.F. Sur., Ordovician wildcat, show oil in upper Ellenburger lime, show oil 5,382-90 ft. and 5,500-10 ft., T.D. 5,665 ft., P.B. 5,509 ft., flowed 36 bbl. oil per day for 3 days, still testing.
Stanolind 1 Conry-Davis, SW SW SW Sec. 31, Blk. 9, H.&G.N. Sur., Ordovician test in Abell area, top anhydrite 365 ft., Yates sand 1,120 ft., drilling 2,674 ft.
O'Quinn 2 O'Neil, S½ Sec. 74, Blk. 10, H.&G.N. Sur., Ordovician test, drilling 670 ft.
Sinclair Prairie 1 Grove, Lot 9, Sec. 26, Blk. 9, H.&G.N. Sur., Ordovician test, fishing 1,360 ft.
Richards 1 Robbins, NW NW Sec. 68, Blk. 10, H.&G.N. Sur., drilling 780 ft.

Loving County

H. C. McAuley 1 E. Hall, SE Sec. 60, Blk. 7, W.N&.W. Sur., drilling 4,510 ft.
Pinal Dome Oil 1 Michigan Oil fee, NW SW Sec. 15, Blk. 26-C, P.S.L. Sur., 5,300-ft. test, 10-in. at 1,172 ft., T.D., waiting on cement.

Reagan County

Amerada 1-RA University, 1,980 ft. from N and 660 ft. from E lines of Sec. 3, Blk. 48, University Sur., Ellenburger lime test, first report.
H. Schooler 1 R. A. Wolters, NE NE Sec. 51, G.C.&S.F. Sur., 8¼-in. 1,262 ft., drilling 1,290 ft.

Reeves County

C. A. Kitsos 1 A. B. Buchard, SW Sec. 7, Blk. 58, P.S.L. Sur., Delaware test, S.D. 630 ft.
Roy Johnson 1 Perkins, Sec. 18, Blk. 7-C, P.S.L. Sur., S.D. 3,355 ft.
J. T. Pemberton 1 fee, NE NE Sec. 2, Blk. 55, Twp. 7, T.&P. Sur., Delaware lime test, 7,500 ft., preparing to start.

Schleicher County

Harold B. Opp 1 Jackson, Sec. 41, Blk. LL, T.C. Sur., T.D. 6,155 ft., fishing tools.

Sutton County

S. B. Roberts 1 George Allison, NW NE Sec. 44, Blk. K, G.H.&S.A. Sur., S.D. 740 ft., casing.
Domain 1 G. S. Allison, SW NE Sec. 91, Blk. 9, T.W. N.G. Sur., Ellenburger lime test, S.D. 1,098 ft.

Terrell County

Texas Consolidated Oil 1 Holmes, NE NE Sec. 14, Blk. 2-A, G.H.&S.A. Sur., 3,600-ft. test, 10-in. 1,100 ft., T.D. 1,275 ft., preparing to start up.
H. H. Sides 1 Rose, Sec. 15, Blk. 148, T.&St.L. Sur., drilling 680 ft.
E. M. Thomasson 3 Bates-Graham, 660 ft. from N and 2,490 ft. from W lines, Sec. 30, Blk. 1, I.&G.N. Sur., S.D. 950 ft.

Upton County

H. C. Wheeler 1 Kincaid, 2,173 ft. from N, 467 ft. from E lines, Sec. 1, G.C.&S.F. Sur., S.D. 10 ft.
Pittman & Atkins 1 Fowler-Starnes, NW NE Sec. 89, G.C.&S.F. Sur., 3,500-ft. test, S.D. 420 ft.

Ward County

Fitzpatrick & Slack 1 Wilson, Sec. 145, Blk. 34, H.& T.C. Sur., 1½ mi. SE of discovery well, T.D. 4,984 ft., 1,400 ft. water in hole, bailing.
Gulf 6 Wristen, 1,997 ft. from SE and 1,989 ft. from NE lines, Sec. 18, Blk. 5, H.&T.C. Sur., drilling 6,243 ft.
Roeser & Pendleton, Inc., and Merry Bros. & Perini 1 Bird Hayes, 467 ft. from SE and SW lines, Sec. 164, Blk. 34, H.&T.C. Sur., ¼ mi. N of discovery gas well, top saturation in Delaware sand 5,089 ft., T.D. 5,396 ft., P.B. 5,130 ft., shot 5,085-5,130 ft., no results, prepare to quit as failure.
J. E. Fitzpatrick 1 T. B. Pruit, SW SW Sec. 23, Blk. 1, W.&N.W. Sur., S.D. 140 ft.

NORTHERN WEST TEXAS

One mile north of the Slaughter field in Hockley County, Magnolia Petroleum Co. is completing its extension well, 1 Maple Wilson, Labor 8, League 41, Maverick County School Lands Survey. With casing perforated with two shots per foot from 4,850-65 ft. and from 4,888-4,900 ft., the section was being given a 1,000-gal. acid treatment at the close of the week. The hole is bottomed at 4,955 ft. with 5½-in. casing cemented at bottom.

Effecting another major extension to the field, however, being in the Cochran County portion, Atlantic Refining Co. has reported official gage for 1 Dean, center of northeastern part of Tract 4, League 89, Lipscomb County School Lands, about 1½ miles southwest of the original Duggan sector of the field. The well pumped 246 bbl. daily with 84 bbl. of water, after a 200-qt. shot and a 9,000-gal acid treatment in the pay section from 5,010-5,111 ft. This is the most southwestern outpost producer for the field and adds several hundred proven acres to the already gigantic field.

Borden County

In Borden County two previously reported wildcat tests were definitely staked and preparations were being made for immediate starting. M. L. Richards has located 1 W. R. Drum, 467 ft. from the south and west

lines of the NE Section 307, Block 97, H.&T.C. Survey. It is a 3,200-ft. test.

The other wildcat is B. C. Mann 1 Canning & Reynolds, located 660 ft. from the north and 1,980 ft. from the east lines of Section 151, Block 25, H.&T.C. Survey. Materials are being rigged up at this test, contracted to 3,000 ft., and spudding is expected this coming week.

NORTHERN WEST TEXAS COMPLETIONS

(24-hour ratings based on last 3 hours of 6-hour gage)

Cochran County

Slaughter field: Atlantic 5 Boyd, 549 bbl., open tubing, 10,000 gal. acid, 4,960-5,069 ft.
Atlantic 1 Dean, extension test, NE Tr. 4, Lge. 89, Lipscomb C.S.L. Sur., 246 bbl. oil and 84 bbl. water, pumping, 200-qt. shot and 9,000 gal. acid, 5,010-5,111 ft.
Magnolia 2-J Mallett, 1,355 bbl., 3-in. casing outlet, 10,500 gal. acid, 4,996-5,044 ft.

Gaines County

Wasson field: Continental Oil 4-43 Langdon, 1,110 bbl., open tubing, 12,000 gal. acid, 4,915-94 ft.

Hockley County

Slaughter field: Awoeb Oil 5 Berry, 1,344 bbl., 2-in. casing outlet, 9,000 gal. acid, 4,905-5,005 ft.
Awoeb Oil 4-A Seale, 994 bbl., 2-in. casing outlet, 9,000 gal. acid, 4,890-4,975 ft.
Delta Drlg. 2-A Slaughter, 303 bbl., 5 per cent water, 4,500 gal. acid, 4,880-4,971 ft.
Fain & Riner 1 Soash, 273 bbl., open tubing, 9,000 gal. acid, 4,880-4,988 ft.
George P. Livermore 4 Glimp, 952 bbl., 2½-in. casing outlet, 10,000 gal. acid, 4,989-5,032 ft.
S. W. Richardson 3-B Slaughter, 342 bbl., open tubing, 10,000 gal. acid, 4,885-4,972 ft.
S. W. Richardson 4-B Slaughter, 983 bbl., 2-in. casing outlet, 10,000 gal. acid, 4,890-4,990 ft.
Western States Gasoline 7 Frazier, 2,202 bbl., open casing, 9,500 gal. acid, 4,945-5,003 ft.

Mitchell County

Dockery-Robbins field: K. A. Eham 1-B Strain, 332 bbl., pumping, 350-qt. shot, 1,620-1,790 ft.

Scurry County

Sharon Ridge field: Magnolia 5 Sterling, 188 bbl., pumping, 760-qt. shot, 2,196-2,455 ft.
Pearson & Sibert Oil 2 Bishop, 177 bbl., pumping, 700-qt. shot, 2,208-2,460 ft.

Yoakum County

Wasson field: Basin States 6 Jordan, 839 bbl., open tubing, 11,000 gal. acid, 5,000-5,284 ft.
Oil Development 15-763 fee, 1,197 bbl., 1⅛-in. choke, 10,000 gal. acid, 5,025-5,270 ft.

NORTHERN WEST TEXAS WILDCAT REPORT

Andrews County

Phillips 1 University-Drews, NW NE Sec. 32, Blk. 10, University Lands Sur., drilling 6,509 ft.
Furham Pet. 1 Lockhart-Brown, Sec. 24, Blk. 42-A, P.S.L. Sur., T.D. 5,600 ft., P.B. 4,558 ft., treated 1,000 gal. acid, retreating 2,000 gal. acid, testing.

Borden County

M. L. Richards 1 W. R. Dunn, SW NE Sec. 307, Blk. 97, H.&T.C. Sur., 3,200-ft. test, first report.
B. C. Mann 1 Canning & Reynolds, NW NE Sec. 151, Blk. 25, H.&T.C. Sur., 3,000-ft. test, first report.

Cochran County

George Livermore 1 Wright, old T.D. 4,997 ft., S.D. 6,621 ft.

Gaines County

Amon G. Carter 4-D Wasson, NW SE Sec. 50, Blk. AX, P.S.L. Sur., logged new pay about 6,610 ft., tight well, application filed to drill to 11,000 ft., S.D. 10,078 ft. (corrected).

Hale County

Humble 1 Byrd, SE SE NE Sec. 17, Blk. K, E.T.R.R. Sur., 9,000-ft. test, location.

Hockley County

Magnolia 1 M. Wilson, SW cor. Labor 8, Lge. 41, Maverick C.S.L. Sur., 1½ mi. N of production in Slaughter field, drilled broken oil shows 4,850-70 ft., top anhydrite 2,150 ft., top salt 2,240 ft., top solid lime 4,020 ft., T.D. 4,955 ft., prepare to treat 1,000 gal.

Lubbock County

A. L. Henderson 1 W. D. McMillan, SE NW Sec. 4, Blk. 2-D, H.E.&W.T. Sur., location.

Martin County

Magnolia 1 N. D. Teague, NW NW Lab. 10, Lge. 260, Borden C.S.L. Sur., 5,500-ft. test, top anhydrite 1,930 ft., top brown lime 3,930 ft., solid lime 4,345 ft., drilling 5,315 ft.

Mitchell County

C. E. Casebolt 1 J. E. Franklin, NE NE NW Sec. 50, Blk. 27, T.&P. Sur., 15½-in. 170 ft., 12½-in. 256 ft., drilling 1,825 ft.

Yoakum County

George Livermore 1 Ownby, NE NE NE Sec. 502, Blk. D, Gibson Sur., drilled broken saturation 5,237-85 ft., flowed several heads oil, treated 3,500 gal. acid, flowed 121 bbl. daily, T.D. 5,294 ft., tested 2,360,000 cu. ft. gas daily, prepare to run liner.

TEXAS PANHANDLE

AMARILLO, Tex., Mar. 24.—The Panhandle field recorded another record number of new locations the past week, there being a total of 21 starts announced the past 7 days. Every producing county in the district was represented. Hutchinson County was far in the lead with 12, Moore County with 4, Gray County with 2, Carson County with 1, and permit was requested for the wildcat test in Potter County just northeast of the city of Amarillo.

Completions for the week totaled 10, all oil wells, for an aggregate initial daily potential of 2,161 bbl.

PANHANDLE COMPLETIONS

(24-hour pumping gages)

Carson County

Magnolia 100 Fee 244, 119 bbl., 140-qt. shot, 3,025-65 ft.
Skelly Oil 115 Schaffer, 349 bbl., 505-qt. shot, 3,007-64 ft.

Gray County

King Oil 8 South Volmert, 216 bbl., 150-qt. shot, 3,220-60 ft.
W. D. Kelley 1 Hood, 287 bbl., 580-qt. shot, 2,960-3,069 ft.
Wilcox Oil & Gas 49 Combs-Worley, 189 bbl., 560-qt. shot, 2,915-3,064 ft.

Hutchinson County

Cree, Hoover & Dye 8 Harvey, 153 bbl., 190-qt. shot, 2,990-3,041 ft.
J. E. Crosbie, Inc., 39 Pitts, 253 bbl., 485-qt. shot, 2,715-2,810 ft.
Phillips Pet. 12 Haile, 222 bbl., 230-qt. shot, 2,998-3,073 ft.
Shell 15 Harvey "B," 191 bbl., 165-qt. shot, 3,016-76 ft.
Shell 9 Harvey, 202 bbl., 195-qt. shot, 2,962-3,040 ft.

SOUTHEAST NEW MEXICO

HOBBS, N. M., Mar. 24.—Development started in the recently opened new gas field of Eddy County, where an offset location was staked. The discovery gasser was W. A. Suddreth and associates 1 Nell H. Wills, which was gaged at 11,000,000 cu. ft. of gas daily after a blowout several weeks ago. The discovery now remains shut down at a total depth of 783 ft. in sand after cementing 8½-in. casing at 738 ft. The main gas pay was logged from 778 to 783 ft. in Yates horizon. The new offset location is C. L. East 1 Wills, 1,980 ft. from the north and east lines of 14-20-28, a ¼-mile-north outpost.

Whiting-Grant Oil has staked a wildcat location in Eddy County and near another wildcat which has been shut down for some time at 2,600 ft. The location is 1 Howell, 1,650 ft. from the south and 2,319 ft. from the east lines of 32-20-25. It is west by southwest of Trojan Oil 1 Grant, wildcat located 2,440 ft. from the north and east lines of 33-20-25, which remains shut down at a total depth of 2,600 ft.

Drilling & Exploration Co. has staked location for an east outpost to the Lea County side of the Maljamar field. It is 2-B Johns, 1,980 ft. from the south and 660 ft. from the west line of 24-17-32.

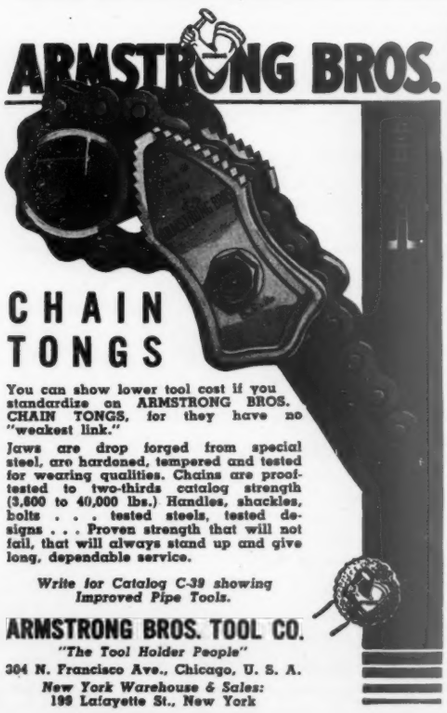
SOUTHEAST NEW MEXICO COMPLETIONS

Eddy County

Wildcat: Dooley & Haynes 1 Martin, SE NW 9-19-25, dry at total depth of 1,000 ft.
Grayburg-Jackson field: Green Bay Oil and Dominion Oil 1 State, 2-17-31, dry at total depth of 4,005 ft.
Dayton field: Brewer Drilling Co. 1 Hoffman, SE SW 24-18-26, flowed 85 bbl. daily, open tubing, 180-qt. shot, 1,040-1,127 ft.
Loco Hills field: Stroup & Yates 1-B Ballard, 6-18-29, flowed 30 bbl. daily, open tubing, 260-qt. shot, 2,451-76 ft. and 2,604-51 ft.
Maljamar field: Emperor Oil 9-A Puckett, SE NW 24-

(Continued on Page 235)

Gotkool
WATER CANS
& COOLERS
GOTT Water Cans are the practical way to keep drinking water cool for long periods, protected from impurities and always handy to the job. Snug fitting large removable top, strongly built to withstand rough usage. GOTT Water Coolers have extra large covers and a handy non-leaking push button faucet. Your Supply Store has them, get one today!
GOTT WATER CAN
Made in 1½, 3, 5, and 10 gallon sizes.
GOTT WATER COOLER
H. P. GOTT MFG. CO.
WINFIELD, KANSAS
KEEP PURE DRINKING WATER ALWAYS HANDY


ARMSTRONG BROS.
CHAIN TONGS
You can show lower tool cost if you standardize on ARMSTRONG BROS. CHAIN TONGS, for they have no "weakest link."
Jaws are drop forged from special steel, are hardened, tempered and tested for wearing qualities. Chains are proof-tested to two-thirds catalog strength (3,600 to 40,000 lbs.) Handles, shackles, bolts . . . tested steels, tested designs . . . Proven strength that will not fail, that will always stand up and give long, dependable service.
Write for Catalog C-39 showing Improved Pipe Tools.
ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
304 N. Francisco Ave., Chicago, U. S. A.
New York Warehouse & Sales:
199 Lafayette St., New York

FOR
GREATER FOOT
PROTECTION
WITH COMFORT
use
DAVENPORT WOOD SOLE
SAFETY SHOES
Comfortable Davenport Wood Sole Safety Shoes are designed to give complete protection from the toughest underfoot conditions. Wood Soles provide safer footing on slippery floors and rough uneven surfaces. Sturdy maple soles, cut for comfortable walking, long outwear ordinary soles. All Davenport Wood Sole Shoes are available with steel or composition Safety Toe. Get FREE Catalog and latest prices. Write today!
F. J. STAHMER SHOE CO.
2363 Boles Avenue
Davenport, Iowa

Wildcatting on Increase in East Texas District

By R. MARNE SANFORD

DALLAS, Tex., Mar. 24.—A total of eight new wildcat tests for the district are either starting or planned. New exploratory holes are definitely starting in Upshur, Fannin, and Houston counties, while proposed wildcats are being considered for Wood, Rusk, Rains, Van Zandt, and Henderson counties. Failures among wildcat operations in the district the past week accounted for the loss of three closely watched tests.

The Hawkins field in Wood County is gaining momentum weekly. At the close of the past week there were 17 drilling wells and 3 active rigs to total 20 active operations for this rapidly developing new field.

Upshur County.—Near Big Sandy in southwestern Upshur County a wildcat test is being planned for the coming week by L. S. Strickland and J. S. White, Longview. The well, 1 Lucy Dell Gorman, is located in the northwest corner of a 144-acre tract in the S. G. Slaton Survey, 1 mile southwest of the town of Big Sandy. It is reported planned as a deep test. If carried below the Woodbine sand it will be the first exploratory test for this area between the Hawkins field to the west and the north end of the East Texas field to the east.

Wood County.—Al Bierman, Tyler, and Byrd-Frost, Inc., Dallas, are reportedly planning a wildcat test to the Woodbine sand on a block of acreage in the townsite of Alba in Wood County. The acreage was acquired several months ago at a consideration of $2 per acre with a Woodbine sand test promised. Starting date and definite plans were not announced.

Rusk County.—A deal is pending by C. C. Thrash of Tyler whereby that operator will deepen an old wildcat test in the Chalk Hill area northeast of Pirtle in northern Rusk County. The test is O. Whittington 1 Kangerga, Castor Survey, started as a deep test but halted last August at 3,093 ft. Thrash is reported to have renewed leases on about 2,500 acres at $1 an acre, agreeing to deepen the hole to the lower Glen Rose levels. Starting date of actual work on the test was not given.

Rains County.—A wildcat test for some time in the future is seen for Rains County where L. C. Prock of Shreveport, La., is offering spreads out of a 5,000-acre block. The acreage lies in the northeastern part of the county and the starting of a test by April 1 is promised.

Fannin County.—In Fannin County H. W. English, Fort Worth, has derrick up for 1 E. Parkhurst, M. P. Davis Survey, 7 miles west of Leonard. The test was announced earlier and is just now getting under way. Location is 200 ft. from the north and 1,020 ft. from the west lines of an 80-acre tract. Contract depth is 1,500 ft.

Van Zandt County.—F. R. Jackson, Longview, is reported to have turned a block of 5,000 acres south and west of Myrtle Springs in Van Zandt County on a proposition whereby a Woodbine sand test would be started by June 1. The block was assembled by M. R. Crow and is in and around the A. Arnold, P. Wade, W. J. Davidson, and other surveys.

Houston County.—Derrick is up for the planned 2,500-ft. Carrizo-Wilcox sand test 5 miles west of Lovelady in Houston County. It is to be G. C. Dixon, Crockett, 1 Texas Long Leaf Lumber Co., 612 ft. from the north and 2,994 ft. from the west lines of the J. Chears Survey, on a 403-acre tract.

Henderson County.—Plans are under way for the drilling of a deep Trinity series wildcat test on the old Roy Black Block 4 miles southwest of Athens in Henderson County. The block has remained intact, changing hands several times during the past 5 or 6 years. At present Ed Howard is submitting spreads for a proposed deep wildcat to start early this spring.

SUMMARY OF COMPLETIONS

East Texas Field

(1-hour gages)

	No.	Bbl.	Footage
Oil: Longview area	7	370	25,308
Kilgore area	5	179	17,885
Total	12	.....	43,193

East Central Texas

Oil: Talco	2	1,500	8,610
Other fields	2	145	13,265
Gas: Hawkins	1	*2.68	4,423
Dry: Wildcats	3	.....	19,093
Total	8	.....	45,391

*Million cu. ft.

Hawkins Field Active

At the close of the past week the Hawkins field reached the greatest pitch of activity since its discovery only 3 months ago. There were a total of 17 drilling wells in the field, several of which were in the completion stages, and three tests were rigging up for starting this week. Bobby Manziel, discoverer of the field, was setting casing at a test which topped the Woodbine sand, Humble Oil & Refining Co. was coring for saturation at two tests on its large block north of the townsite of Hawkins, while within the townsite General American Oil, Bracken Oil, and several others were preparing to complete wells. To keep the pace on the increase, Humble announced the past week locations for five new tests in the northern part of the field.

EAST TEXAS FIELD COMPLETIONS

(Gages through open tubing)

Gregg County

Longview area: General Crude 14 Rembert, 20 bbl. in 30 min., 3,491-95 ft.
Gulberson 2-C Christian, 30 bbl. in 30 min., 3,459-3,561 ft.
L. G. S. Oil 9-C McQueen, 35 bbl. an hr., 3,632-42 ft.
Trapp & Blankenship 2 Fenn, 40 bbl. in 30 min., 3,600-01 ft.
John Wrather 3 Alexander, 200 bbl. in 8 hr., 3,602-04 ft.
Kilgore area: B. Holcomb 3-A Clayton, 50 bbl., 3,520-75 ft.
T. D. Humphries 32 A. Spear, 25 bbl. an hr., 3,535-75 ft.
T. D. Humphries 34 A. Spear, 25 bbl. an hr., 3,548-74 ft.
T. D. Humphries 35 A. Spear, 25 bbl. an hr., 3,548-75 ft.
Shell 14-B Elder, 18 bbl. in 20 min., 3,542-86 ft.

Upshur County

Longview area: Margay Oil 18 Victory, 20 bbl. in 30 min., 3,628-39 ft.
Mudge Oil 19-A Free, 45 bbl. in 30 min., 3,668-3,766 ft.

Week of March 10-15

Gregg County

Longview area: General Crude 5 fee, 21 bbl. in 30 min., 3,492-97 ft.
L. G. S. Oil 7-C McQueen, 20 bbl., 4 hr., pumping, 3,610-20 ft.
Kilgore area: Shell 7 Watson, 48 bbl. an hr., 3,545-56 ft.
Hall & Hall 7 Dickinson, 150 bbl. in 15 hr., 3,529-52 ft.
C. C. Julian 10 Engold, 30 bbl. in 40 min., 3,516-56 ft.

Rusk County

Joiner area: A. G. Fullerton 4 Pinkston, 60 bbl. an hr., 3,655-60 ft.
W. W. Hinchliffe 3 Pinkston, 60 bbl. an hr., 3,641-56 ft.

Upshur County

Longview area: Shell 31 Landers, 15 bbl. in 30 min., 3,656-66 ft.

EAST CENTRAL TEXAS COMPLETIONS

Anderson County

Long Lake field: Alex McCutchin 1 Evans, 74 bbl., 6/64-in. choke, 5,280-85 ft.

Camp County

Pittsburg field: Gulf 1 Venters, top Austin 3,702 ft., Woodbine 4,015 ft., Georgetown lime 4,667 ft., Goodland 5,570 ft., Paluxy 5,615 ft., Glen Rose 5,904 ft., anhydrite 6,910 ft., massive anhydrite 7,140 ft., Oolitic anhydrite 7,615 ft., Pettit 7,935 ft., perf. casing 7,936-64 ft. and 7,970-90 ft., 71 bbl. daily, flowing.

Franklin County

Talco field: Humble 4 Young, 51 bbl. in 2 hr., pumping 4,285-4,302 ft.
Talco Asphalt Co. 7 Rutherford, 151 bbl. in 4 hr., flowing 4,275-98 ft.

Leon County

Wildcat: H. A. Lindsay 1 White, McKinney & Williams Sur., 1 mi. SE of Buffalo, top Pecan Gap at 3,917 ft., Austin chalk 5,254 ft., dry at T.D. 6,060 ft.

Rusk County

Wildcat: Skelly Oil 1 Markey, A. Nolen Sur., 4 mi. SE of Mt. Enterprise, top Austin chalk 3,352 ft., Georgetown lime 3,584 ft., Paluxy 4,335 ft., anhydrite 5,435 ft., massive anhydrite 6,150 ft., dry at 7,505 ft.

Wood County

Hawkins field: Humble 1 Bryant, top Woodbine 4,229 ft., gas sand 4,229-4,423 ft., 2,680,000 cu. ft. gas daily, ¼-in. choke.
Wildcat: Bryan Consolidated Oil and W. C. McGlothlin 1 J. E. Gaut, William Clark Sur., top Midway 1,504 ft., Navarro 2,320 ft., Nacatoch sand 2,470 ft., Pecan Gap 3,162 ft., Austin chalk 4,817 ft., Woodbine 5-497 ft., dry at 5,528 ft.

EASTERN TEXAS WILDCAT REPORT

Anderson County

Griffith Bros. 1 Clayton, William Frost Sur., Elkhart area, S.D. 50 ft.
R. H. & W. Oil 1 Saunders, 17-acre tract in Joseph Ferguson Sur., in Frankston townsite, top sub-Clarksville 4,874-4,910 ft., fishing 5,225 ft.
Texas 1 Greenwood, M. Salisar Sur., 4 mi. NW Palestine, drilling 3,900 ft.

Camp County

Lucey 1 McKenzie, L. William Sur., ¾ mi. W of Pittsburg field, moving in rotary.

Fannin County

H. W. English 1 Parkhurst, M. P. Davis Sur., 7 mi. W of Leonard, first report.

Houston County

G. C. Dixon 1 Texas Long Leaf Lbr. Co., J. Chears Sur., 5 mi. W of Lovelady, first report.

Lamar County

Whitehead & Dahl Bros. 1 J. M. Barr, P. Compton Sur., 9 mi. S of Paris, location.

McLennan County

E. P. Campbell 1 Stewart, S. Burton Sur., 5 mi. N of Waco, S.D. 765 ft.
Frank Place 1 Hackney, I. Robbins Sur., 4 mi. SE of McGregor, drilling 1,018 ft.

Robertson County

C. C. Baker & Son 1 Middleton, J. S. McNeil Sur., 2 mi. S of Elliott, S.D. 20 ft.
H. A. Clary 1 A. G. Scott, H. F. Thornton Sur., 2 mi. W of Franklin.

Navarro County

Hargrave Oil 1 C. S. West, M. Boren Sur., 1½ mi. S of Richland, T.D. 3,257 ft., salt water.

Rusk County

Delta Drilling Co. 1 Kangerga, 113-acre tract in R. Lane Sur., 3 mi. N of Henderson, 8,200-ft. test, top Glen Rose 4,764 ft.," first anhydrite 5,560 ft., second anhydrite 5,930 ft., drilling 6,190 ft.
Beddinghouse 1 J. A. McCreary, H. Huejas Sur., 6 mi. SW of Enterprise, S.D. 204 ft.

Upshur County

Sun Oil 1 W. C. Henderson, NW cor. of 27-acre tract in 100-acre tract in Robertson Asher Sur., just outside town of Ore City, 7,000-ft. test, top first anhydrite 6,079 ft., second anhydrite 6,676 ft., drilling 6,712 ft.

Wood County

Jackson & McGlothlin 1 Moore, 10-acre tract in Joseph Knight Sur., in Crow townsite, Woodbine sand test, drilling 3,381 ft.

Permian Basin, Panhandle

(Continued from Page 234)

17-31, flowed 50 bbl. daily, 4,000 gal. acid, 3,890-3,976 ft.

SOUTHEAST NEW MEXICO WILDCAT REPORT

Chaves County

L. E. Elliott 1 State ..... NW NE 16-11-31
Drilling 3,485 ft.
Roxana Oil 1 Maull ..... NE NW 11-12-25
Setting 8¼-in. at 624 ft., last report.
A. F. Pierce 1 Franks ..... SE NW NW 17-9-5
T.D. 990 ft., P.B. 887 ft., shot 40 qt. 864-87 ft., testing.
Holmes-Martin 1 Stephens ..... C NW NE 22-15-29
Old well drilling deeper, T.D. 3,210 ft.
H. Steinberger 1 Headley ..... NW SW 26-14s-29e
T.D. 3,405 ft., sulfur water 3,400-5 ft.
R. T. Wilson 1 L. B. Brown ..... C NW SW 29-11-23
T.D. 890 ft., last report.

Eddy County

Harry W. Long 1 Anderson ..... N½ 16-22-20
Location.
G. M. Cone 1 Hare ..... NW NW NE 11-16-28
Old well drilling deeper, T.D. 1,830 ft., showing est. 250,000 cu. ft. daily, testing.
Mac T. Anderson 1 Brainard ..... NE NE 28-18-27
T.D. 2,415 ft., last report.
Jack Harris 1 Josey ..... SW SE 19-20-23
T.D. 643 ft.
Jones & Yates 1 Everest ..... NE SE 15-18-26
270-qt. shot 1,934-84 ft., and 670-qt. shot 1,485-1,710 ft., set new casing, still testing.
Olen F. Featherstone 1 Johnson ..... SW SW 10-19-27
Location.
J. H. Rives 1 Boulter ..... SW SW SW 21-19-27
First report.
Basin Oil 1 Kimmell ..... NE NE NE 5-20-26
1,620-ft. test, drilling 420 ft.
W. A. Suddreth 1 N. H. Wills, 6 mi. W of Getty field, NW SE 14-20-28, gas sand 778-83 ft., tested 7,000,000 cu. ft. daily, trying to cement casing at 638 ft. after braden head blew off, gas volume increased to 11,000,000 cu. ft. daily, S.D. at T.D. 783 ft.

By

T. R. INGRAM

Baker-Glendive Anticline to Get 10,000-Ft. Test

DENVER, Colo., Mar. 24.—A 12-year attempt to test the Dakota sand in an Adams County wildcat in Colorado ended this week when casing was being pulled to abandon with hole still 1,100 ft. above objective.

Ohio Oil Co. 12 State is showing for a producer and will mark a slight extension of Dakota horizon at Rock Creek, Carbon County. Only completion in Wyoming was Paul Boether 1 Government, Hidden Dome district, a dry hole.

Carter Oil Co. has contracted to drill a 10,000-ft. test on the Baker structure, eastern Montana, to start by May 1. Glacier Production 5 Van Ormer proved to be a 320-bbl. well in Cut Bank. One other producer in the field was same company's 3 McDougal for 46 bbl. A ½-mile extension is imminent on the west side of South Cut Bank in A. B. Cobb 2 Tribal. Kevin-Sunburst had a small extension to the west in High Gravity 1 Government, which is pumping 4 bbl. a day.

SUMMARY OF COMPLETIONS

	No.	Bbl.	Footage
Wyoming			
Dry holes	1	.....	2,559
Montana			
Oil wells	3	370	7,986

COLORADO

Adams County

Glenridge Oil Corp. 1 Hills, SE SE SE 27-3s-64w, Watkins district, is pulling casing to abandon. Total depth is 4,388 ft. This wildcat has had a rather varied career. It was started in the spring of 1929 by Nettie M. Slatt to go to 5,500 ft. The block around the well comprised 100,000 acres. Nettie Slatt died in 1931 and the operation was taken over by her brother, Carl Slatt, administrator. Subsequently he died, and H. G. Wilkinson, of Colorado Springs, took over the management. Several good shows of oil and gas were reported, and outside geologists put the top of the Hygiene group at 3,750 ft., where it showed enough saturation in shale to squeeze out with the hand. One obstacle after another followed, and the hole, which was in good shape up to this point, went bad. After several additional attempts to complete it, the efforts finally were abandoned on account of lack of funds. Location is 24 miles east of Denver, and the test was rather an important one, but failed to reach the objective. Altogether half a dozen reorganizations were effected in trying to reach the Dakota.

Boulder County

J. A. Warren 3 Maxwell . . . NW NE NW 24-1n-71w
Temporarily S.D. at 1,370 ft.

El Paso County

F. F. Hintze 1 State . . . . . CEL SE SE 16-11s-60w
S.D. 1,840 ft.

La Plata County

Nick Spatter 1-X Bryce . . . . . SW SW 31-33n-9w
Drilling 4,428 ft. in hard sand.

Larimer County

J. E. Carruthers 1 Hogsett . . . . . NE SE NE 20-4n-69w
Spudded and S.D.

Moffat County

Mountain Fuel Supply 7 Wilson, East Hiawatha, mago to 7,500 ft. to test sands in the Mesa Verde, according to unverified reports. Only test to that horizon was drilled in 1933 in J Wilson, C NE NE 22-12n-100w, which was plugged back and completed in the Wasatch as a small gas well after going to 7,577 ft. No. 7 Wilson is drilling in soft sand at around 2,500 ft. At 2,202 ft., total depth, with tester seated at 2,043 ft., it made 1,090,000 cu. ft. of gas through drill stem, and at 2,341 ft., with tester seated at 2,259 ft., it showed 540 ft. of oil and some gas in 1½ hours. First Wasatch sand was at 2,126-82 ft. and second sand at 2,259-2,354 ft.

Mountain Fuel Supply 7 Wilson . . . . . NE SW NW 23-12n-100w
Coring below 2,430 ft.

Mountain Fuel Supply 3 Musser . . . . . CNL NW SW 5-11n-97w
Drilling 3,241 ft.

Rio Blanco County

The United Oil Production Co. is being organized by Cliff Rockhill, Burton Coles, and associates, to drill 10 to 20 wells to shallow-production horizons in the Rangely field along the calcite seams which have yielded some good producers in the past 2 years. They have acquired around 700 acres. First operations will include three wells which will be spotted following a survey by C. E. Shoenfelt, consulting geologist, of Denver.

Texas Co.-California Co. 5 Unit, discovery in the Sundance sand at Wilson Creek, was unable to obtain a test of that horizon at 6,570 ft. through perforated casing on account of ice forming on the apparatus, and gun-perforating is again in progress.

Equipment is being moved in for 6 Unit, ½ mile north of 5 Unit, which will test the Sundance in that direction. Footage is 2,420 ft. north of south line and 1,216 ft. west of east line.

Texas Co. 6 Unit . . . . . NW NE SE 27-3n-94w
Moving in, first report.

WYOMING

Big Horn County

McDonald & Curtis 1 Orchard . . . SE NW 24-51n-93w
S.D. 1,235 ft., weather.
N. B. Ketchersid 1 Mann . . . . . SW SW SW 11-55n-97w
S.D. 625 ft. for 10-in. casing.

Carbon County

Ohio 12 State, which will prove up a ¼-mile extension of the Rock Creek field in the Dakota on the northwest, is a near completion. It set the 5-in. on top of the Muddy at 3,601 ft., and had the top of the Dakota at 3,674 ft. At 3,693 ft. it swabbed 36 bbl. in 24 hours, and is drilling deeper. So far it has not had any water. It is a southeast offset to 2 Lundy, which was a failure.

Sinclair-Wyoming 22 Wertz, a location, is a west offset to 16-A Wertz, which made 900 bbl. initially in the Tensleep. It is an outside well.

Sinclair-Wyoming 22 Wertz . . . . . SE SE SE 1-26n-90w
Moving in, first report.
Sinclair-Wyoming 18 Wertz . . . . . SE SE NW 7-26n-89w
Drilling in Tensleep at 5,963 ft. and flowing.
Sinclair-Wyoming 5-C Mahoney . . . C NW SE 34-26n-88w
Drilling 1,707 ft., formerly No. 5-F.
Ohio 12 State . . . . . C W½ NE 34-20n-78w
Drilling 3,715 ft.

Fremont County

Indian Oil, agent, 2 Tribal . . . . . SW SW NW 23-6n-2w
Drilling 300 ft., set 10-in. at 295 ft.
V. M. Kirk 2 Tribal . . . . . NW SE NE 22-6n-2w
Corrected location.

Natrona County

K. S. Albert 1 Young . . . . . NE SE 25-32n-82w
Drilling 310 ft.

Niobrara County

Ohio 7 Converse Sheep . . . . . C NW SE 32-36n-65w
Drilling 4,624 ft.
Continental 1 Rohlff . . . . . CSL SE NW 32-36n-65w
Drilling 4,457 ft. in red beds.
Argo 16 Elliott . . . . . NW SE NW 5-35n-65w
Drilling 5,540 ft., red marker 4,940 ft.
Continental 2-A Schuricht . . . . . C SE NE 6-35n-65w
Drilling 5,224 ft. in lime, red marker 4,907 ft.
Continental 24 Tom Bell . . . . NW NW NW 34-36n-65w
T.D. 5,342 ft., swabbed 200 bbl. in 24 hr. after acidizing, testing.

Park County

Enalpac 3 Pauline O.P.C.-1 . . . . . SE SE 5-51n-100w
Spudded, waiting on rotary.
Stanolind 6 Rosenberg . . . . . NW NW NW 25-58n-98w
S.D. 2,765 ft. for orders.
Enalpac Oil & Gas 1 Cactus . . . SW SE SE 33-51n-100w
T.D. 3,408 ft., 7-in. at 3,338 ft., perf. with 94 holes at 3,265-3,320 ft., testing.

Sublette County

Charles Lackey 1 Government NE SE SW 33-27n-113w
S.D. 1,260 ft.
Marvel Oil 6 Government . . . CEL SE SE 28-27n-113w
Cemented 7-in. at 1,125 ft.

Sweetwater County

Sinclair-Wyoming 96-A . . . . . NE SE NE 10-26n-90w
Drilling 2,843 ft.
Sinclair-Wyoming 95-A . . . . . SW NW NW 11-26n-90w
Drilling 4,182 ft. in Tensleep, top at 3,829 ft.

Washakie County

Paul Boether 1 Government, SW SW NW 4-47n-90w, Hidden Dome area, was plugged and abandoned at 2,595 ft. It had water in the Frontier, the producing horizon at 1,205-23 ft.

MONTANA

Fallon County

Confirmation of reports in circulation for some time that the Carter Oil Co. will drill a deep test this year in the Baker field on the Baker-Glendive anticline in eastern Montana was given this week in the annual report of the Montana-Dakota Utilities Co. Fidelity Gas Co., a 100 per cent subsidiary, holds the operating rights for the development of oil and gas below 2,000 ft. covering approximately 120,000 acres. In 1935 to 1937 the company drilled three tests. No. 1 Unit, NE NE NW 17-4n-62, was completed at 8,186 ft. for 200 bbl. a day. Its 3 Smith-Unit 8, C SE NW 8-4n-62e, was drilled to 6,811 ft. and completed as a producer, reported 350 bbl. a day, of which 50 per cent was water. Its 2 Warren-Unit 5, C SW 23-8n-59e, was dry at 7,360 ft. No oil has been marketed from the two producers.

In June 1940 a preliminary contract was made with Carter, providing for the drilling of other tests. Carter had survey crews working during the summer of 1940 making geophysical surveys. At the completion of these last November, Carter obligated itself to drill at its own expense a new deep test at the south end of the Baker field. Contract provides drilling will begin by May 1, 1941, and will continue to 10,000 ft. unless commercial production is encountered at a lesser depth. Montana-Dakota will realize 25 per cent of net proceeds from the development. Location of test has not yet been released.

Fergus County

Tony Co. 2 Scharf . . . . . NW SE NW 36-22n-17e
Drilling 355 ft., 8⅝-in. at 155 ft., first report, Winifred district.

Glacier County

A west extension of nearly ½ mile at the south end of the Cut Bank field is imminent in A. B. Cobb & Co. 2 Tribal-187, SW SW NW 19-32n-5w, which is drilling into the Cut Bank sand at 2,942 ft. with 1,500 ft. of oil in the hole. The hole was drilled to 2,926 ft. last December and was shut down after cementing the 7-in. at 2,922 ft. Completion was held up pending sale of adjoining tribal leases. Two weeks ago Cobb purchased Tract 5 comprising 96.5 acres offsetting the well on the west for a bonus of $61 an acre, and Tract 15, comprising 80 acres offsetting the well on the south for a bonus of $100 an acre. Drilling on the test then was resumed. The location of 2 Tribal is ⅝ mile west of nearest producer.

Glacier Production 5 Van Ormer, 220 ft. north of C NE NW 17-33n-5w, swabbed 320 bbl. the first 24 hours at 2,924 ft. after plugging back 1 ft. The Sunburst sand at 2,840-79 ft. had a show of oil at 2,848-56 ft. The 7-in. was cemented on top of the Cut Bank at 2,880-2,924 ft.

Glacier Production 3 McDougal, C NW NW 31-34n-5w, swabbed 46 bbl. in 24 hours at 2,857 ft. after plugging back from 2,862 ft., from the Cut Bank sand at 2,796-2,857 ft. Main pay was at 2,853-57 ft.

Glacier Production 6 Van Ormer, 330 ft. N of . . . . . CSL SE 8-33n-5w
Spudding 210 ft., first report.
Glacier Production 2 Federal Land Bank . . . . . C SE SW 30-34n-5w
Rigging, first report.
Consolidated Gas 1 Tribal . . . . . Lot 8, 10-34n-6w
Cemented 7-in. at 2,921 ft.
A. B. Cobb 2 Tribal-187 . . . . . SW SW NW 19-32n-5w
Drilling 2,942 ft.
Glacier Prod. 3 Corrigeux, 1,320 ft. from W and 440 ft. from N line 21-33n-5w
Drilling 1,520 ft., top Colorado 575 ft., 10¾-in. 599 ft.
Hannah-Porter 1 Tribal-189 . . . . NW SW SE 19-32n-5w
Drilling 1,400 ft., top Colorado 525 ft.
Santa Rita 3 Jordan . . . . . C SE NE 7-32n-5w
Standing 585 ft., rig burned down, waiting on equipment.
Ed Reagan 1 Tribal-194 . . . . . CEL SE NE 22-37n-7w
Coring for Cut Bank sand at 3,806 ft.

Toole County

The Kevin-Sunburst field was 19 years old on March

14, anniversary of the bringing in of the discovery well in Gordon Campbell-Kevin Syndicate 1 Goeddertz, NE NE 16-35n-3w, at 1,786 ft. for 20 bbl. a day in the Ellis. The well, however, never was commercially produced as it was drilled deeper and ran into water. The country then was wild and wooly and the discovery started a boom which became known far and wide.

The secretary of the interior defined the boundaries of the known producing oil and gas field as of April 20, 1926, on the recommendation of the U. S. Geological Survey, within which were 47,691 acres. The only addition subsequently made was 220 acres, bringing the total up to 47,911 acres, of which 11,280 acres were federal; 3,440 acres state; and 33,191 acres were fee land.

A well record of the field as of November 1940, by the Montana Oil Conservation Board showed that up to that time 1,922 wells had been drilled, of which 752 had been plugged and abandoned, 1,106 were oil producers, 43 produced gas only, 7 were drilling, and the remainder were suspended. Another report by the same board as of December 31, 1935, which has since shown no great change, gave 5,935 acres in production, 39,871 acres untested, and 2,105 acres abandoned or not commercial. The field produced 37,874,117 bbl. up to the end of 1940. Year of peak production was in 1926, when the output was 6,479,892 bbl. Production in 1940 was 1,884,170 bbl.

Total footage drilled in the field, at an average of 1,600 ft. to the well, is 3,075,000 ft., or a little more than a total of 582 miles. At an average of $10,000 per well, drilling costs were approximately $19,000,000.

The only completion for the week was High Gravity Oil Producing Co. 1 Government, SE NW NE 19-35n-3w, coincidentally an extension outside of the defined boundaries on the anniversary of the field's birthday. It was drilled to 2,200 ft. and plugged back to 2,170 ft. and acidized several times. It is pumping 4 bbl. a day. It is located on the rimrock of Virgil sandstone on the west with an elevation of 2,800 ft. Nearest wells are two producers and a dry hole in the E½ of Section 20, and two dry holes in the NE of Section 30.

Ohio 6 Howling ..... SW SW NW 10-35n-2w
Drilling 1,240 ft., 8¼-in. at 1,055 ft.
Dunkirk Adventure 1 McKechnie NW SW SE 2-31n-1w
Cemented 10-in. on bottom at 385 ft.

NORTHWEST NEW MEXICO

Bernalillo County

David H. Boyd 1 Wright 11-10n-5e
Drilling 187 ft.

Sandoval County

Sieman & Boyd 1 Armijo ..... SE SW 1-12n-3w
T.D. 715 ft., show oil in sand topped at 711 ft., will run 8-in., first report, location 6 miles SE of Continental Oil Co. dry hole at 5,962 ft., in 2-13n-4w, drilled in 1935.

San Juan County

Carroll & Carroll 2 Government C NW NW 12-29n-12w
Drilling 1,610 ft.
Red Cactus Oil 1 Tribal ..... SE SE SE 35-29n-18w
Drilling 1,500 ft., Dakota dry.

California Fields

(Continued from Page 219)

few days. The company started work on this property 2 weeks ago but was forced to shut down temporarily due to bad roads. Aztec Oil Co. has a rig up on the Sanborn lease in 6-3n-16w on the Pico anticline and will begin hauling in rotary equipment within the next few days. Financing difficulty held up this well for several weeks but now everything has been finished except the actual starting of work. Several operators holding considerable acreage nearby on the major Pico anticline are contributing dry-hole money in one form or another. This location has special merit and it would not prove surprising if Aztec Oil Co. completes a large well. It is the present intention to drill entirely through the Modelo if necessary to make a conclusive test. Geological data anticipate commercial production in the upper Modelo. Western Gulf Oil Co. is building derrick for a second well to be drilled on the Lechler property in the Oak Canyon field of Los Angeles County where the company completed a small pumping well several weeks ago. This new well will be carried down into the Modelo below the depth reached in 1 Lechler in order to determine the possibility of developing large production of light refining crude oil. The Texas Co. has stepped into the Newhall district and is grading location and roads for a well to be drilled on the Whitnah property in 14-3n-16w. This well will be drilled in about the center of the section. In the Del Valle field, discovered several months ago by R. E. Havenstrite, this operator's 1 Vasquez located south of the discovery well is nearing top of the Miocene at 5,898 ft. and should core into the Modelo momentarily if it is found as expected.

Rincon.—Chanslor Canfield Midway Oil Co. with three strings of tools in operation in the Rincon field of Ventura County is grading for two additional wells to be drilled on the Hobson lease. These locations now being drilled by Chanslor Canfield Midway Oil Co. are inside locations and not being subjected to drainage were not developed immediately subsequent to discovery of the Rincon field. Recent completions have come up to expectations and initials have ranged from 150 bbl. to 750 bbl. daily. Richfield has location staked for a new well to be drilled on Hobson U. S. lease in 8-3n-24w but derrick equipment has not yet been placed on ground. The Rincon field is located at the extreme western end of the Ventura Avenue anticline where it plunges beneath the Pacific Ocean. It has not been especially productive as total production to the end of January 1941 has only been 12,716,341 bbl.

COASTAL DISTRICT WILDCATS

Castaic District

Barnsdall 1-17-A Honor rancho 5-4n-16w
Rigging up rotary tools. Los Angeles County.
Morse-Mangold 1 McDermott 26-5n-17w
Rigging up rotary tools. Los Angeles County.

Del Valle District

Havenstrite, R. E. 1 Vasquez 21-4n-17w
Drilling in sandy shale 5,902 ft. Believed near top of Miocene. Located SE of discovery well. Elev. 1,102 ft. Los Angeles County.
Universal Consd. Oil Co. 1 Dennis 21-4n-17w
Derrick erected. Elev. 1,006 ft. Los Angeles County.

Goleta District

Del Mar Oil Co. 1 Goleta 11-4n-28w
Rigging up rotary drilling equipment. Santa Barbara County.

Newhall District

Aztec Oil Co. 1 Sanborn 6-3n-16w
Grading roads and laying water line. Rig material will be on ground within few days. Elev. 1,516 ft. Los Angeles County.
Purman, H. T. 1 Needham 13-3n-16w
Grading road and location. Expect production around 1,500 ft. to 1,600 ft. Elev. 1,681 ft. Los Angeles County.
Texas 1 Whitnah 14-3n-16w
Building rig and roads. Located on major Pico anticline. Los Angeles County.

Oak Canyon District

Western Gulf 2 Lechler 31-5n-17w
Grading location. Contemplate deep test to lower Modelo. Los Angeles County.

TO ALL

Natural Gasoline Men

Greetings

FROM THE

NATURAL GASOLINE SUPPLY MEN'S ASSOCIATION

We are looking forward to seeing you at the

TWENTIETH ANNUAL CONVENTION

of the

NATURAL GASOLINE ASSOCIATION OF AMERICA

April 23-25, Baker Hotel

Dallas, Texas

Members of the Natural Gasoline Supply Men's Association:

The American Rolling Mill Company
The Bristol Company
The Brown Instrument Company
Butane-Propane News
Chaplin-Fulton Manufacturing Company
Chicago Bridge & Iron Company
Clark Brothers Company
Continental Supply Company
Cooper-Bessemer Corporation
Joseph A. Coy Company
The Fisher Governor Company
The Foxboro Company
Frick-Reid Supply Corporation
Gasoline Plant Construction Corporation
Goulds Pumps, Inc.
Hanlon-Waters, Inc.
Hercules Motors Corporation
Ingersoll-Rand Company
Warner Lewis Company
Mason-Neilan Regulator Company
C. A. Mathey MacLine Works
Metric Metal Works
Merco-Nordstrom Valve Company
Mid-Continent Engineering Company
Midwest Piping & Supply Company
Moorlane Company
National Petroleum News
National Tank Company
Naylor Pipe Company
The Oil and Gas Journal
Petroleum Engineering, Inc.
The Petroleum Engineer
Pittsburgh Equitable Meter Company
The Refiner & Natural Gasoline Manufacturer
The Refinery Supply Company
Taylor Instrument Company
Tulsa Boiler & Machinery Company
Vinson Supply Company
Westcott & Greis, Inc.
Woobank Pump & Machinery Company
Worthington Pump & Machinery Corporation
Wyatt Metal & Boiler Works
John Zink Burner Company

Drilling Retarded by Cold and Bad Weather Conditions

By STAFF CORRESPONDENT

PITTSBURGH, Pa., Mar. 24.—During the past week in the lower eastern fields, nine operations were reported completed of which one was dry, seven gas wells, and one oil producer. Much of the work was retarded by the severe cold weather and bad-road conditions.

SUMMARY OF COMPLETIONS

Southwest Pennsylvania

	No.	Prod.	Footage
Dry holes	1	.....	3,379
West Virginia			
Oil wells	1	4	1,999
Gas wells: Oriskany field	1	*17.0	5,124
Other fields	6	*1.1	15,634
Total	8	.....	32,757
Recompletions	1	*0.1	.....

*Million cu. ft.

SOUTHWEST PENNSYLVANIA

On Chestnut Ridge in South Union Township, Fayette County, New Penn Development Co., William E. Snee et al temporarily bottomed 3 Summit Hotel (Heyn) on account of actual gas demand at 6,609 ft. with an open flow of 1,950,000 cu. ft. of gas all from the Onondaga chert beds. Here, the top of the Onondaga chert was placed at 6,395 ft. and the top of the Oriskany sand at 6,565 ft. making a normal Onondaga chert section of 170 ft. However, one or two of the larger pays from chert beds were missing and the 44 ft. of Oriskany drilled was also void. The well will be deepened later when the gas is needed.

Here, Peoples Natural Gas Co. is drilling 4 Piedmont Coal Co. at 5,225 ft. In North Union Township, Wasson & Co. et al are still trying to drill up the baller lost in the bottom part of the Marcellus in the 2 J. H. Sorg.

In Maryland New Penn Development Co., William E. Snee et al failed to complete the string of casing to 6,000 ft. in the test on the Humberson farm on the Accident dome in Garrett County. At 4,842 ft., the casing stuck and it was necessary to pull the entire string. An attempt is being made to straighten the hole at this point. On Laurel Ridge in Stewart Township, Fayette County, Pennsylvania, these operators and E. G. Mueller are resuming operations in the deep test on the Gregg L. Neel farm which had reached a depth of 8,004 ft. without striking the Lower Devonian. A new cable has been installed and drilling will be resumed this week.

Indiana County

White Township: T. W. Phillips 1 Ella B. Campbell, dry, through Bradford, T.D. 3,379 ft.

DRILLING

Armstrong County

Boggs Township: John Wray et al 1 Ralph Williamson, 2,820 ft., fishing.
Kittanning Township: L. L. Livingood 1 H. Wright 1,678 ft.
Local company 1 S. E. Heilman, 1,460 ft.
Equitable 1 Mary Stitt, 2,260 ft.
Plum Creek Township: Peoples 2 W. J. Boyer, 3,724 ft., S.D.
Peoples 1 G. Boyer, 295 ft.
James Wright 1 fee, 2,670 ft.
Red Bank Township: Local company 1 Samuel Kunselman, 420 ft.
South Bend Township: Equitable 2 Margaret Claypool, rigging up.
Valley Township: Humphrey, Stone & McCall 1 J. McAfoose, 2,300 ft.
Wayne Township: R. C. Galbraith 2 William Alcorn location.

Clarion County

Limestone Township: Owens-Illinois Glass Co. 1 Clark Steel, 1,325 ft.
Monroe Township: Owens-Illinois Glass Co. 1 J. W. Altes, 1,600 ft.
Red Bank Township: T. W. Phillips 1 Daniel Wolfgang, 750 ft.

Fayette County

Franklin Township: Eberly et al 1 Clifton, 3,440 ft.
German Township: Eberly et al 2 Felix Valerio, 2,250 ft.
Greensboro Gas Co. 1 Stephen Haningosky, 960 ft.
Nicholson Township: Duquesne Gas Co. 2 Jacob Cover, rigged up.
C. V. Emmers 1 Joseph Vaslaviski, 210 ft.
Springhill Township: Marker Stephenson et al 1 John and Agnes Brojkovich, spudding 25 ft.

Greene County

Center Township: Manufacturers 1 E. W. Wood, location.
Jackson Township: Equitable 1 Clara Roberts, 1,385 ft.
Peoples 1 Roy L. Wise, 1,371 ft.
H. E. Milliken et al 1 E. Cheney, 2,850 ft.
Cleveland Cameron O. & G. Co. 1 Cleveland Morris, Fifty-foot sand 2,884-2,902 ft., gas 112,000 cu. ft. and oil 5 bbl. at 2,889-2,902 ft., drilling at 3,005 ft.
Monongahela Township: Equitable 1 William Hart, 1,305 ft.
Greensboro Gas Co. 1 Longenecker heirs, 2,710 ft.
D. E. Mayne et al 1 Andrew Kovack, 1,940 ft.
Judson Bell et al 2 E. R. Gabler, 1,558 ft.
Judson Bell et al 3 E. R. Gabler, moving in rig.
Brummage et al 1 Robert Whooley, 1,645 ft.
John Conklin et al 1 S. L. Mestrezat, 125 ft.
Morris Township: Romney Rutan et al 1 Albert Rutan, 1,250 ft., S.D., new line.
Perry Township: Equitable Gas Co. 1 C. D. Wade, building road.
Richhill Township: Charles Hart et al 1 Ross Galloway, 450 ft., underreaming.
Springhill Township: H. E. Milliken et al 1 John Minor, 1,320 ft.
Wayne Township: Lee Wise et al 1 Henry Hixenbaugh, location.
Whiteley Township: H. D. Freeland et al 1 Morris B. Fox, building rig.

Indiana County

Armstrong Township: T. W. Phillips 1 Lewis Weiss, 2,092 ft.
Center Township: T. W. Phillips 1 Charles Johnston, 2,875 ft.

Washington County

Amwell Township: Bungard et al 1 Lucille Frazee, 585 ft.
Hanover Township: D. D. Caldwell et al 3 Evaline Caldwell, 1,555 ft.
Morris Township: Carnegie 2 Nelan heirs, 1,897 ft.
Union Gasoline & Oil Co. 4 W. E. Craft, 2,661 ft.
Conger et al 1 C. W. Archer, 920 ft.
Mount Pleasant Township: McGuigan et al 1 H. S. Buchanan, 320 ft., Pittsburgh coal top 267 ft.
Somerset Township: Equitable 1 Jerry Myers, gas sand 1,243 ft., 267,000 cu. ft. gas 1,261-66 ft., drilling 1,271 ft.
West Bethlehem Township: Carnegie 3 Chartier Southern R. R., 2,470 ft.
West Finley Township: Natural W. Va. 1 Robert Marshall, 2,560 ft.

Westmoreland County

Allegheny Township: Peoples 1 Howard Wise, 2,714 ft.
Bell Township: Dome Gas Co. 2 J. F. Wolford, 3,760 ft.
Upper Burrell Township: Peoples 1 W. H. Wylie, 3,035 ft., lost string of tools and cracker.

WEST VIRGINIA

In Monongalia County the wildcat of the Hope Natural Gas Co. on the H. C. Greer et al lease in Morgan district on Chestnut Ridge, is drilling at 850 ft. In Harrison County this company's deep rotary test on the C. S. Gribble farm in Grant district is drilling at 9,928 ft.

In Ravenswood district, Jackson County, none of the wildcats drilling have reached any important markers.

Braxton County

Birch district: Pittsburgh & W. Va. Gas Co. 7789 Ed L. Boggs, 59,000 cu. ft. gas, Blue Monday sand (Woodcock sandstone of the Catskill), T.D. 1,938 ft.

Cabell County

Barboursville district: Merrits Creek Gas Co. 1 A. Arnold, 73,000 cu. ft. gas, 7 hr. after shot, Big lime 1,357-1,538 ft., Injun 1,590-1,683 ft., Berea 2,144-57 ft., brown shale 2,870-3,202 ft., gas 3,000 ft., 3,100 ft., 3,130 ft., shot 2,890-3,210 ft.
Barboursville Fuel Gas Co. 1 Barboursville Clay Manufacturing Co., drilled deeper, 73,000 cu. ft. gas, started deepening 2,215 ft., brown shale 2,850-3,050 ft., and 3,260-3,350 ft., Corniferous lime 3,350 ft., gas 3,232-39 ft., gas 3,290-3,300 ft., gas with 3,050 lb. gelatin 2,960-3,350 ft.

Clay County

Buffalo district: Pittsburgh & W. Va. Gas Co. 7790 Amanda A. Byrne, 300,000 cu. ft. gas before shot, through Injun sand, T.D. 2,176 ft.

Harrison County

Eagle district: Eagle Gas Co. 1 John Hustead, 125,000 cu. ft. gas, Gordon sand 2,485-2,513 ft., gas 2,495-2,513 ft., Fourth sand 2,540 ft., gas 2,545-57 ft., T.D. 2,564 ft.

Ritchie County

Murphy district: Kight & Mackey 1 Alexander 7 Julia Mackey, 260,000 cu. ft. gas, Maxton sand, T.D. 1,579 ft.

Wayne County

Union district: Owens, Libby-Owens 1 J. D. Baker 240,000 cu. ft. gas 46 hr. after shot, Big lime 1,189-1,399 ft., Big Injun 1,399-1,448 ft., Berea 2,003-34 ft., brown shale 2,464-2,915 ft., and 3,116-57 ft., Corniferous lime 3,157 ft., gas 2,710-21 ft., gas 2,800 ft., shot with 4,500 lb. Dentonite 2,467-2,941 ft.

Wetzel County

Grant district: Hope 1 Michael Barr, 4 bbl. and 100,000 cu. ft. gas, Big Injun sand, T.D. 1,999 ft., drilled by Carnegie Natural Gas Co. and transferred to Hope Natural Gas Co.

ORISKANY GAS FIELDS

Kanawha County

No wells were completed in Kanawha County during the week.

Jackson County

Washington district: Columbian Carbon Co. 1 W. D. Kiser et al, 17,000,000 cu. ft. gas, Corniferous lime 4,976-5,090 ft., Oriskany 5,090-5,124 ft., gas 5,091-5,111 ft., gas 5,111-24 ft., T.D. 5,124 ft.

NEW WORK

Boone County

Scott district: Owens, Libby-Owens 588 Cassingham Coal Land Co., elev. 1,220.1 ft.
Owens, Libby-Owens 589 Cassingham Coal Land Co., elev., 1,340.8 ft.

Doddridge County

West Union district: Braden & Creighton 1 Flora E. Martin, elev. 894 ft.
Braden & Creighton 1 T. D. Swiger, drill deeper.

Gilmer County

Glenville district: Pittsburgh & W. Va. Gas Co. 7799 Opha Wolfe, elev. 791 ft.
Pittsburgh & W. Va. Gas Co. 7800 Lester Davis, elev. 1,110 ft.

Harrison County

Eagle district: Eagle Gas Co. 1 Louisa A. Lyons, elev. 1,124.31 ft.

Kanawha County

Washington district: Owens, Libby-Owens 11 Siler Coal Land Co., elev. 626.9 ft.

Putnam County

Curry district: Jackson Gas Co. 3 W. A. Rupe, elev. 790 ft.
Reishman O. & G. Co. 2 W. G. May, elev. 669 ft.
United Fuel Gas Co. 5003 N. J. Oxley, elev. 740 ft.

Taylor County

Booths Creek district: Pittsburgh & W. Va. Gas Co. 6115 A. J. Mason, elev. 1,168 ft.

Gas Development on Increase In Northern Oriskany Area

COUDERSPORT, Pa., Mar. 24.—Two new locations were staked in the northern Oriskany sand gas field during the past week. The Belmont Quadrangle Drilling Corp. is moving in on the Mina G. Phipps farm in Allen Township, Allegany County, New York, and the Penn York Natural Gas Co. has located 1 Hamilton in West Union Township in Steuben County, New York.

It was in West Union Township that Belmont Quadrangle Drilling Corp. had a 14,389,000-cu. ft. initial open flow in 1 George Lewis last week, the best well in the field since Empire Gas & Fuel Co. completed its C. A. Wilson well on May 31, 1940, with an initial open flow of 16,000,000 cu. ft. The George Lewis well extends a pool in that area. The only other good well in that immediate area was Penn York 1 Sarah Nixon, which was completed in October with an initial open flow of 8,000,000 cu. ft. Belmont's other test in that region was 1 James Hamilton, which was watered out when completed at 4,942 ft. Penn York 1 James Harden in that same area (elevation 2,315 ft.) is drilling at 4,235 ft.

Belmont 1 George Lewis got the top of the Onondaga lime at 4,972 ft. and the top of the Oriskany sand at 5,009 ft. First gas, 350,000 cu. ft., was encountered at 5,012 ft. Initial open flow was gaged at 14,389,000 cu. ft. with initial rock pressure of 1,825 lb.

Leiderbach et al 1 J. Schaumberg in Howard Township, Steuben County, New York, was completed at 3,582 ft. with an initial open flow of 2,500,000 cu. ft. of gas. The top of the Oriskany sand was encountered at 3,570 ft. and the first gas gaged 500,000 cu. ft. After the shot the flow increased to 2,500,000 cu. ft. with an initial rock pressure of 1,400 lb. The completion was the twelfth to date this year. Only four other active operations are under way in the field.

Port Allen Test May Give West Baton Rouge Parish First Field

By F. L. SINGLETON

NEW ORLEANS, La., Mar. 24.—Operators in the Gulf Coast district centered their attention on the Port Allen prospect, West Baton Rouge Parish, where Amerada 1 Wilberts Sons Lumber & Shingle Co. was coring below 9,986 ft. following an attempted blowout at 9,985 ft. Before the well was killed it blew drilling mud, slightly cut with oil and gas. The top of the sand section was 9,981 ft., and an electrical survey and sidewall cores showed favorable indications. The Heterostegina formation was topped at 7,680-7,700 ft., and a fault is reported to have been crossed at approximately 9,200 ft. which makes the well correlate higher than wells in the University field located about 12 miles due east in East Baton Rouge Parish.

The following showings were recorded by the electrical survey: Sand with a slight show on normal curve at intervals from 8,992-9,086 ft. From 9,252-71 ft., 100 mv. porosity and 7 ohms resistivity on normal curve, 9,366-74 ft., 50 mv. porosity and 5 ohms resistivity on normal curve, 9,430-58 ft., sand with a slight show on normal curve, and sand with a slight show from 9,526-44 ft. From 9,556-74 ft. 100 mv. porosity and 9 ohms resistivity was recorded, and from 9,604-30 ft., 90 mv. and 32 ohms resistivity, 9,647-66 ft. 105 mv. and 16 ohms resistivity. Location is in 26-7s-11e. Casing is expected to be cemented some time next week. This is the first activity to be started in the parish in several months, and if the well is successfully completed, it will open the first production for the parish.

WESTWEGO.—In Jefferson Parish and located about ¼ mile east of the discovery well of the Westwego field, Reese E. Carter 1 Craven is bottomed at 9,755 ft., and 7-in. casing was cemented at that depth and the well is expected to be tested the first of the week. An electrical survey showed the sand section from 8,993-9,036 ft. This is considerably higher than the discovery well which was originally completed for a producer in sand at 9,830-42 ft. The discovery well, Titanic 1 Marrero Land & Investment Co., was abandoned the previous week due to mechanical trouble as the operators were attempting to retest another sand.

SUMMARY OF COMPLETIONS

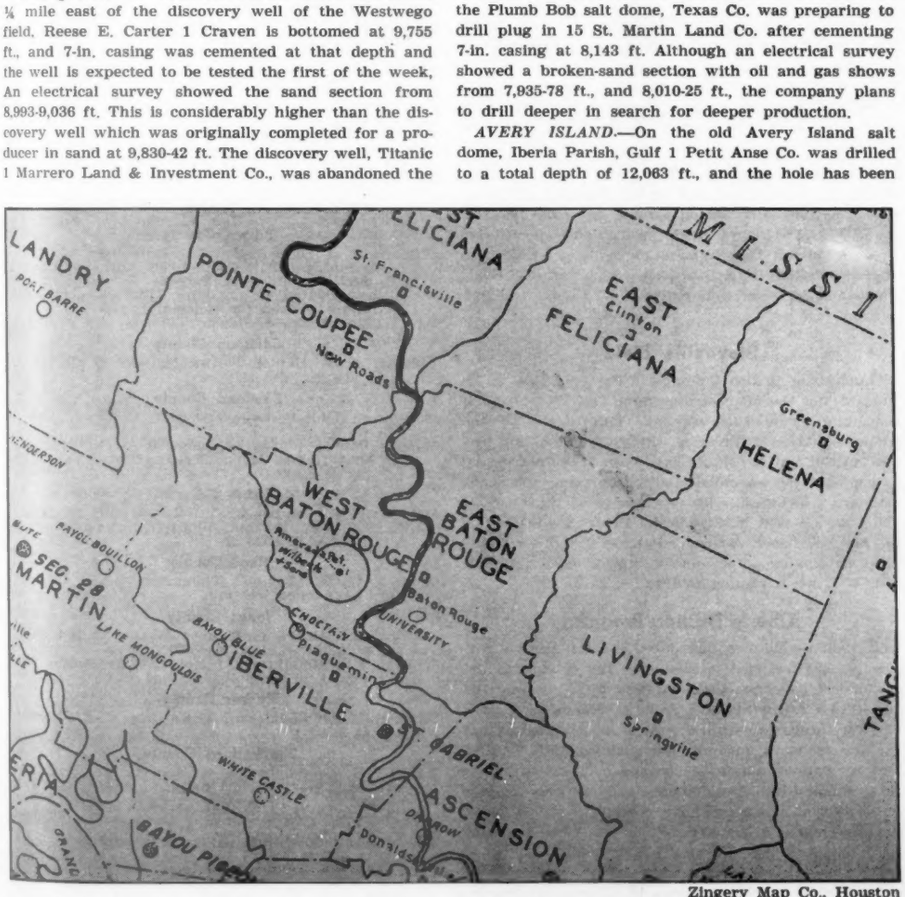
	No.	Bbl.	Footage
Oil wells: Fields	8	2,083	74,406
Dry holes: Fields	2	.....	10,271
Wildcats	2	.....	22,819
Total	12	.....	107,496

EOLA.—S. W. Richardson 2-D Haas Investment Co., an exploratory deep test in the Eola field, Avoyelles Parish, is drilling in shale below 11,180 ft. which makes it the deepest test ever drilled in the Louisiana sector of the Wilcox trend. According to an electrical survey the Wilcox was topped at 8,512 ft., and at the present depth the well is approximately 2,668 ft.

SECTION 28.—On the north flank of the Section 28 dome, St. Martin Parish, Superior Oil Co. of California 1-B St. Martin Land Co., swabbed a slight amount of oil and gas from perforated casing at 9,340-60 ft., and the company at the close of the week was attempting to test the interval from 10,052-94 ft. where an electrical survey is reported to have shown possible production. The 9,300-ft. horizon compares with the discovery sand, while any production developed from the 10,000-ft. horizon would open a new sand for this old salt structure.

PLUMB BOB.—In the same parish, and located on the Plumb Bob salt dome, Texas Co. was preparing to drill plug in 15 St. Martin Land Co. after cementing 7-in. casing at 8,143 ft. Although an electrical survey showed a broken-sand section with oil and gas shows from 7,935-78 ft., and 8,010-25 ft., the company plans to drill deeper in search for deeper production.

AVERY ISLAND.—On the old Avery Island salt dome, Iberia Parish, Gulf 1 Petit Anse Co. was drilled to a total depth of 12,063 ft., and the hole has been plugged back to 5,400 ft. and the company is attempting to sidetrack. An electrical survey showed sand sections in the original hole at 11,148-67 ft. and 11,186-11,200 ft.



Zingery Map Co., Houston

Amerada 1 Wilberts Sons Shingle & Lumber Co., a prospective pool opener in West Baton Rouge Parish, and its relation to other producing fields

Wildcat Tests

Lisbon-Iberia Oil Co. is reported to be working its block of several thousand acres in the Branch area, centering in 9s-2e, and drilling is scheduled to be started on the block within the next few months. A 10,000-ft. dry hole was drilled in the area last year by Humble Oil & Refining Co. which discovered the area by geophysical exploration in 1934.

Location for another projected deep test was announced for Terrebonne Parish by Gulf Refining Co. The well is 1 Emite Picou, located approximately 6 miles southeast of the De Large field, the discovery well of which is the deepest producing well in the world. The discovery well, Fohs 1 Buckley & Bourg, is producing gas and distillate from sand at 13,254-66 ft.

GUEYDAN.—On the south flank of the Gueydan field, Vermilion Parish, Union Sulphur 1 J. B. Baker, recovered salt water on a 10-minute drill-stem test in the newly opened 9,200-ft. pay and the well is drilling ahead in sandy shale below 9,496 ft. Fohs 3 Mulvey Irrigation Co., which drilled into salt the previous week at 7,614 ft., has been plugged back from a total depth of 7,699 ft., and the well is drilling ahead in shale after sidetracking at 5,100 ft.

LOUISIANA GULF COAST COMPLETIONS

Cameron Parish

West Hackberry field: Stanolind 24-C Cameron Parish School Board, 468 bbl., ⅞-in. choke, perf. casing 9,925-51 ft., T.D. 10,050 ft.

Evangeline Parish

Ville Platte field: Continental 7 Hirsch, 77 bbl., ⅞-in. choke, T.D. 10,215 ft.

La Fourche Parish

Golden Meadow field: Texas 18 E. B. Falgout Holding Co., 541 bbl., 12/64-in. choke, T.D. 10,445 ft.
Texas 18 La Terre Land Co., 338 bbl., 12/64-in. choke, sand 10,319-10,414 ft., T.D. 10,485 ft.

Plaquemines Parish

West Bay field: Tide Water 1 State, 130 bbl., ⅛-in. choke, perf. casing 6,262-74 ft., T.D. 7,400 ft.

St. Bernard Parish

Wildcat: California 1 Biloxi Marsh Lands Co., dry, T.D. 11,164 ft.
Kenilworth field: Vendome Petroleum Corp. 1 Kenilworth plantation, 40 bbl. distillate, ⅛-in. choke, perf. casing 10,356-62 ft., T.D. 10,648 ft.

St. Charles Parish

Lake Salvador field: Texas 6 State, 374 bbl., ⅞-in. choke, perf. casing 10,225-65 ft., T.D. 10,388 ft.

St. Martin Parish

Anse La Butte field: Glassell & Glassell 1 Bendel, dry, T.D. 4,614 ft.
Stanolind 4 Bergeron, 115 bbl., 9/64-in. choke, perf. casing 4,742-72 ft., T.D. 4,775 ft.
Bayou Bouillon field: Superior 6 Rycade, dry, T.D. 5,657 ft.
Wildcat: Shell 1 Duck Lake-State, dry, T.D. 11,205 ft.

LOUISIANA GULF COAST DRILLING REPORT

Calcasieu Parish

Gulf 1 Calcasieu National Bank, Hayes prospect, 18-11s-5w, drilling shale 9,172 ft.
Gulf 1 Miller, southeast flank Edgerly field, drilling shale 7,650 ft.

Cameron Parish

Superior 1 Miami Corp., south of Grand Lake field, 29-14s-3w, drilling shale and lime 8,630 ft.

Plaquemines Parish

Phillips 1 State-Bastian Bay, 48-20s-29e, drilling shale 11,987 ft.
Texas 1 State-Delacroix, 34-15s-14e, drilling shale 10,675 ft.

St. Mary Parish

E. G. Bateman et al 1 W. P. Foster, Franklin prospect, 38-15s-9e, T.D. 10,481 ft., drilling out cement 10,459 ft., preparatory to drilling deeper.
Humble 1 Marin, Bayou Sale prospect, 16-16s-9e, drilling shale 1,804 ft.

Vermilion Parish

Phillips 1 Dugas, Erath field, drilling shale 8,156 ft.
Texas 1 Broussard, Erath field, drilling shale 11,371 ft.

Illinois Fields

(Continued from Page 230)

lost tools in hole, recovered tools, swabbed 167 bbl. in 6 hr., testing.
Hiawatha Oil 1 Vail ..... NW NW SE 19-7s-11e
Set 10-in. 123 ft., drilling 175 ft.
Travis 1 Davis ..... SE SW NE 30-4s-9e
Menard lime 2,505 ft., Vienna 2,594 ft., Tar Springs 2,616 ft., Tar Springs 2,645 ft., Glen Dean 2,700 ft., Hardinsburg 2,786 ft., Golconda 2,835 ft., Barlow 2,962 ft., Paint Creek sand 3,088 ft., Benoist sand 3,125 ft., Renault 3,158 ft., Aux Vases 3,200 ft., Ste. Genevieve 3,306 ft., S.D. 3,495 ft.
Jarvis Bros. 1 E. H. Morris ..... SW NW NE 20-5s-14w
First report, rigging up rotary.
Buell-Herndon 1 Parker ..... SW NW NW 35-5s-10e
Location, first report.

Williamson County

Sun 1 Old Ben Coal ..... NE NE NW 13-8s-2e
Location, first report.

February Production Fails to Reach Board Allotment

By VICTOR LAURISTON

CHATHAM, Ont., Mar. 22.—Official figures of the federal Department of Trade and Commerce show that crude and naphtha production from all Canadian fields in 1940 totaled 8,718,053 bbl. compared with 7,837,503 bbl. in 1939. Comparative figures for the various provinces are as follows:

	Barrels	
	1940	1939
New Brunswick	21,161	20,101
Ontario	186,471	205,978
Alberta	8,493,237	7,594,411
Northwest Territories	17,184	17,013

Natural-gas production marketed from all Canadian fields in 1940 totaled 35,952,500,000 cu. ft. compared with 35,185,146,000 cu. ft. in 1939.

Turner Valley Crude

Crude production from 135 Turner Valley wells in February totaled 686,850 bbl. comparing with a Conservation Board allotment for the month of 705,693 bbl. Major producers in February included Alberta Oil Incomes 2, with 17,947 bbl.; Home Oil 2, with 17,367 bbl.; Foothills Oil & Gas 5, with 16,081 bbl.; Home Oil 3, with 15,264 bbl., and Foothills Oil & Gs 7, with 14,558 bbl. All these were in North Turner Valley. New completions in production for part of February included: Home Oil 1, with 12,347 bbl.; Home Oil 6, with 1,603 bbl.; Royalite Oil 53, with 6,950 bbl., and Royalite 54, with 1,865 bbl.

The tentative allowable for Turner Valley crude wells of 806,000 bbl. for March, or 26,000 bbl. a day, has been reduced to 779,274 bbl. The daily decrease is to make up for those wells which exceeded their quota in February. In the March schedule, four producers, previously listed as gas-naphtha wells, are transferred to the crude category. They are: Miracle Oils 2, with 9 bbl. a day; Model-Spooner 1, with 24 bbl.; Sterling-Pacific 3, with 30 bbl., and Model Oils 3, with 11 bbl. Their inclusion brings the total number of Turner Valley crude producers to 137, with two wells testing.

Turner Valley Lime Tests

North Turner Valley.—Major Oil Investments 1, LSD 5, 34-20-3w5, got the Madison limestone at 6,406 ft., and is preparing to resume after cementing production casing. This, the most northerly test to get the lime, has logged much shallower than the Home producers.

West Central field.—Okalta Oil 10, LSD 12, 18-19-2w5, 19-19-2w5, is below 7,746 ft. after cementing in the lime at 7,506 ft. Independent Royalties 1, LSD 7, 24-19-3w5, is below 7,884 ft., after getting the lime at 7,755 ft. Anglo-Phillips 2, LSD 9, 35-19-3w5, is below 7,572 ft., more than 300 ft. in the lime, and will probably be the next completion, testing a new area well to the north of the West Central field.

New Tests Starting

North Turner Valley.—Atlas-British Dominion 2, LSD 4, 17-21-3w5, the most northerly test in the field, has spudded and is below 223 ft.

Royalite-Model 1, LSD 1, 22-30-3w5, has secured permit. Location is on acreage of Model Oils, in the same LSD as Model 3, now rated a crude producer with 11 bbl. a day. It got the lime at 5,730 ft. and finished at 6,234 ft. Permit is granted on condition that Model 3 be plugged and abandoned, though abandonment will not be required till Royalite-Model 1 is completed. Royalite 58 has location in LSD 7, same section, offsetting Model 1 producer.

West Central field—Alberta Pacific Royalties 1, LSD 14, 6-19-2w5, is spudding.

Sunray Petroleum 1, LSD 8, 13-19-3w5, resuming from 6,777 ft. after a prolonged shutdown.

Southwest field.—Northwest-Hudson's Bay 6, LSD 7, 8-18-2w5, has secured permit. Location is south and west of other producers and near what is generally regarded as the southwest limit of the field. Northwest company is a subsidiary of Imperial Oil and affiliate of Royalite Oil Co. and has been systematically testing a southwest extension of the field.

Tests in the Foothills

Clearwater structure.—Clear Oils 1, LSD 8, 2-35-10w5, has taken oil-saturated core from the Devonian lime between 1,326-33 ft., and may test production beofre deepening.

Moose dome.—McColl-Frontenac Oil 1, LSD 9, 6-23-6w5, has completed drill-stem test of section between 4,915 and 5,098 ft., which showed a small gas flow in a porous horizon of the Devonian. Well will be deepened till hard rock is encountered when further production test will be made.

Border Fields

Blood Indian Reserve.—Northwest-West Petroleum 1, LSD 3, 20-5-23w4, is deepening below 6,887 ft., more than 767 ft. in the lime.

Lethbridge structure.—Lethbridge Petroleums 1, LSD 12, 11-8-22w4, has been taken over by Brown Oil Corp. and associated interests and resumed drilling from 3,325 ft. It is in the Blairmore formation, after encountering a substantial gas flow in the lower Alberta shales, and will be deepened to test the Madison lime which is expected around 4,000 ft. Test is logging about 400 ft. higher than Texas-Imperial 1, some 3 miles to the northwest, which got noncommercial crude showings but is believed located on the wrong side of the fault.

Barnwell field.—Border Petroleums 1, LSD 5, 32-19-17w4, standing in the lime at 3,480 ft., is pumping water with considerable crude, and has recovered around 300 bbl. of 20-gravity oil. Pumping is being continued to reduce the water volume in the hope of making a commercial well. Two grades, a heavy black crude and a lighter oil, are indicated.

Keho dome.—Keho Dome Oils, with Julius Zaetschky of Calgary as president and Arthur Roberts of Barons, vice president, is arranging for No. 1, a cable-tool test in LSD 3, 18-11-22w4, with production expected between 3,750 and 3,800 ft. Location is about a mile west of Hudson's Bay Oil & Gas Co. 1, which got good crude shows and for some time had a small commercial production.

Steveville Field

Standard of British Columbia 3 Princess, LSD 5, 13-20-12w4, got the Madison limestone at 3,230 ft. and is deepening below 3,259 ft., and close to the horizon where Standard 2 Princess, discovery well, got production. Oil and gas shows have been encountered, and casing will be cemented and production test made. Standard 2 Princess, with potential production of 520 bbl. a day, is shut in. Standard 4 Princess, LSD 13, 12-20-12w4, is rigged. Anaconda-Patricia 1, LSD 9, 31-20-12w4, is rigging rotary outfit. Steveville Oils 1, LSD 5, 18-20-11w4, is rigging rotary.

Alberta Drilling Program

New oil regulations introduced by the Alberta government are intended to encourage the systematic and economical development of Alberta oil resources. Remote areas are withdrawn from development, to provide for future exploration and to concentrate present exploratory work on areas more conveniently located. The regulations aim to encourage cooperative rather than competitive development, and provide for the unitization of acreage and the possible participation of the government in actual development. A bonus system is contemplated for discovery wells, under which these will be exempted from certain royalty payments or drilling costs credited against lease rentals. The Alberta Conservation Board is given closer control of all operations, and operators are required to furnish exact drilling reports, geological information, and other data.

Saskatchewan Operations

Franco Oils, which is planning to law a 175-mile 10-in. natural-gas transmission line from the Lloydminster field to Saskatoon this year, is arranging for development in several Saskatchewan areas on the basis of seismographic surveys made for the company by the Heiland Research Corp. Acreage has been secured in the Muddy Lake area, 7 miles south of the Unity-Vera field, and a well will be undertaken this spring. Geological information indicates a dome structure with satisfactory closure. Acreage has also been secured in the Lone Rock area, 20 miles southeast of Lloydminster, where another test may be drilled. Some 10,000 acres in Saskatchewan northeast of the Battleview-Vermilion field have also been leased, and may be tested; while production and drilling operations will be carried on in the Vermilion and Lloydminster fields.

West Central Texas Fields

(Continued from Page 215)

Elliott discovery is about 100 ft. deeper than a large number of holes drilled and plugged in the vicinity during the past 20 years and is a new producing level in that area. The Hope sand is the next deeper horizon below the Humble sand and is also untested in many of the shallower sand producing spots of this area. Elsewhere in the county the Hope sand is one of the most prolific and long-lived producing levels in the district.

Deep Discovery

A new Caddo lime oil field for eastern Throckmorton County was seen the past week as Humble Oil & Refining Co. tested 1 McKnight, Block 2, D.L.&C. Survey, 9 miles northwest of Woodson and about 6 miles east of the town of Throckmorton. The wildcat topped the Caddo lime at 4,020 ft. and cored saturation from 4,042-52 ft. Estimated at 8 bbl. daily, natural, the well was acidized with 5,000 gal. after which it flowed and cleaned itself into the pits. Then turned into storage it flowed 18 bbl. of oil in 15 minutes through ½-in. choke on tubing. The gas volume was registered at 4,000,000 cu. ft. daily.

The discovery is 3 miles northwest of an old Caddo lime pool discovered by Humble about 15 years ago. At that time the company erected a $400,000 natural-gasoline plant, but the pressures in the field dropped off very rapidly, hence the field furnished the plant only a little oil. The new discovery is expected to stimulate further exploration in the district as well as provide crude for the plant should a field develop around the discovery well.

WEST CENTRAL TEXAS COMPLETIONS

Brown County

Wildcat: J. O. Hart & Son 1-C Pugh, Sec. 40, Moses Little Sur., top Palo Pinto 1,255 ft., dry at 1,335 ft.
A. J. Stokes 1 Boyston, Prosper Mangel Sur. 604, made 29,000 cu. ft. gas daily, 3,000 gal. acid, 1,648-64 ft., to be used for ranch purposes.
Bangs field: Hogan & Stewart 3 Perry, dry at 915 ft.

Coleman County

Wildcat: A. F. Heinze 1 Kincaid, Sec. 41, B.B.B.&C. Sur., dry at 3,645 ft.

Eastland County

Hightower field: Petroleum Prod. 1 Blackwell, dry at 808 ft.
Wildcat: W. L. Fetty 1 Morgan, P. A. Barnhill Sur. 53, Abst. 12, top Caddo 2,464 ft., Marble Falls 2,841 ft., dry at 2,900 ft.

Fisher County

Wildcat: F. A. Stephenson 1 Baberry, Sec. 56, Blk. 1, H.&T.C. Sur., 111 bbl. oil in 10 hr., pumping, 50-qt. shot, 3,277-3,320 ft.

Hood County

Wildcat: W. G. Martin 1 Thompson, B. F. Anderson Sur., abandoned location.

Jones County

Higgs field: George Callihan 4 Higgs, 57 bbl. daily, pumping, 20-qt. shot, 1,845-60 ft.
Wildcat: Fain-McGaha Oil 1 Moore, T. D. Maltby Sur., 252, dry at 2,538 ft.

Parker County

Wildcat: Holland-Leidecker 1 Keeling, F. Liddy Sur., dry at 2,407 ft.

Shackelford County

Wildcat: N. Grossenbacher & Hagerty 1 Elliott, Sec. 12, L.A.L. Sur., 15 bbl. daily, pumping, 830-36 ft., natural.
R. H. Roark 1 Lee, Sec. 37, Blk. 12, T.&P. Sur., dry at 1,181 ft.
Shackelford field: Estate of Thomas Wittmer 5 Lones, dry at 837 ft.
Cook field: Roeser & Pendleton and Continental 3-A-118 Cooke, 102 bbl. oil and 3½ bbl. water, 1,691-94 ft.
Lynch field: T. A. Collier 1 Lynch, dry at 2,173 ft.
Newell field: Rhodes & Higher 20 Davis, 39 bbl. daily, 20-qt. shot, 1,183-1,203 ft.

MICHIGAN OPERATIONS

Deerfield-Isabella Gas Field Opened in Michigan Stray

By OTTO C. PRESSPRICH

SAGINAW, Mich., Mar. 24.—Natural-gas development overshadowed crude-oil activities in Michigan during the past week with the opening of a new Deerfield-Isabella pool and announcement of plans by Taggart Brothers of Big Rapids for extensive drilling this year in Osceola, Missaukee and Clare counties.

Six oil producers were completed during the week, three in Ottawa County for total potential of 230 bbl. a day, two in Allegan for 140 bbl. and the other a 90-bbl. well in the Adams-Arenac field. Drilling activity centered in Allegan, but six of the eight completions were dry holes. Also dry was a Kawkawlin-Bay test, one in Lenawee County and two others in Van Buren.

SUMMARY OF COMPLETIONS

	No.	Bbl.	Footage
Oil wells: Allegan County	2	140	3,959
Arenac County	1	90	2,982
Ottawa County	3	230	5,619
Gas wells: Isabella County	1	*5.84	1,256
Dry holes: Allegan County	6	.....	9,103
Others	4	.....	9,741
Total	17	.....	29,668

*Million cu. ft.

Crystal.—Water continued to cut into production as American Drilling Co. maintained pump tests of its 1 Skidmore wildcat in Crystal Township, Ogemaw County, which encountered Traverse lime oil pay at 1,806 ft. a few weeks ago.

Similar difficulty was encountered with the Homer Fulton 1 Spencer in Section 13 of Crystal-Montcalm. Meanwhile operations have been suspended on an offset to the wildcat.

Adams.—Watched was Don Rayburn 1 Fox extension test in Section 21 of Adams-Arenac. A half mile west of production it was scheduled to reach Dundee around 2,900 ft. early this week. In Section 15 Pure Oil Co. continues deepening of its 2-A State. It is reported below 4,500 ft., deepest yet drilled in the field. There was a show of oil around 4,300 ft.

Deerfield.—The Deerfield gas well, Burrass & Quinlan 1 Winesburgh in Section 20 may be either a new field or an important extension of the Broomfield pool. Two miles from any other production, the gas yield was rated at 2,500,000 cu. ft. a day from Michigan stray sand at 1,285-91 ft. The test started originally for oil. Gas production of the Wise-Isabella pool was boosted by completion of W. E. Ross 1 Slocum in Section 28, its daily potential being 5,840,000 cu. ft. a day.

AVERAGE DAILY PRODUCTION

	Mar. 22
Temple	7,289
Buckeye	1,916
Walker	5,122
Van Buren County	2,953
Allegan County	4,563
Wise	1,261
Adams	3,298
Total Michigan	37,946

With Michigan production continuing its decline, it barely exceeded 1,000,000 bbl. in February, according to the Michigan Oil and Gas Association tabulation, Midwest Refineries at Alma has begun taking delivery on Illinois crude. B. J. Skinner, Midwest president, said the company is planning tanks for 300,000 bbl. extra storage, bringing capacity near 800,000 bbl., in Alma and Grand Rapids. About 100,000 bbl. of Illinois crude has been purchased, it is said, but for storage to be drawn on in the event Michigan fields fail to provide requirements.

Michigan's February production was 1,004,056 bbl or a daily average of 38,002 bbl., lowest since July 1936, and compared to a daily average of 40,137 bbl. in January.

Last week's list of oil and gas-drilling permits issued by the state Conservation Department revealed four locations in Allegan County, two in Ottawa, one each in Arenac, Gratiot, Osceola, Isabella and Van Buren. The 11 increased the total for the year to 165.

MICHIGAN COMPLETIONS

Allegan County

Cheshire Township: Lang & Lewis 1 Moore, SW SW NE 28-1n-14w, dry, T.D. 1,260 ft.
Salem Township: Rex Oil & Gas Co. 1 Palmbos, SW SE SE 4-4n-13w, dry, T.D. 1,679 ft.
George L. Kernodle 1 Ledger, NW NW NW 14-4n-13w, dry, T.D. 1,611 ft.
Socony-Vacuum Oil Co. 2 Green, NE NE NW 14-4n-13w, 100 bbl., acid, T.D. 1,584 ft.
J. H. McLean 1 Zerfas, NE NW NE 15-4n-13w, dry, T.D. 1,607 ft.
Michigan Devonian Petroleum Co. 4 Smith, NW SE NW 15-4n-13w, dry, T.D. 1,599 ft.
Trowbridge Township: Bridger Basin Oil Corp. 1 Foster, NE NW SW 29-1n-13w, 40 bbl., acid, T.D. 1,365 ft.
J. H. McLean 1 Forester, SW NW SW 32-1n-13w, dry, T.D. 1,348 ft.

Arenac County

Adams Township: Chapman Oil Co. 2 McTaggart, NW NE NE 26-19n-3e, 90 bbl., acid, T.D. 2,982 ft.

Bay County

Kawkawlin Township: J. C. Hirschfield 1 Salois, SW SW NE 20-15n-4e, dry, T.D. 3,065 ft.

Isabella County

Wise Township: W. E. Ross 1 Slocum, SE NW SE 28-16n-3w, 5,840,000 cu. ft. gas, T.D. 1,256 ft.

Lenawee County

Deerfield Township: George L. Kernodle 1 Timmins, NE SE NE 36-6s-5e, dry. T.D. 2,226 ft.

Muskegon County

Dalton Township: Edward B. Strom 1 Kopps, SW NE SE 9-11n-16w, location abandoned.

Ottawa County

Tallmadge Township: Smith Petroleum Co. 2 Moelker, NE NE SW 1-6n-13w, 5 bbl., acid, T.D. 1,903 ft.
J. C. Newell 2 Rapp, SW NW SE 23-6n-13w, 75 bbl., acid, T.D. 1,875 ft.
Swanson Consolidated Oil Co. 2-A Sutter, SE NE NE 33-6n-13w, 150 bbl., acid, T.D. 1,841 ft.

Van Buren County

Bloomingdale Township: Bloomingdale Development Co. 3-A West, NE NE NE 18-1s-14w, dry, T.D. 1,236 ft.
Columbia Township: Lang & Lewis 2 Summy, SW SE SE 1-1s-15w, dry, T.D. 1,214 ft.

MICHIGAN CRUDE-OIL RUNS

(Daily average for February 1941)

Pool—	Wells	Runs
Porter-Yost	337	4,566
Greendale-Chippewa	176	1,133
Sherman-Isabella	61	982
Varnon-Leaton-Denver	73	620
Wise-Isabella	62	1,289
Reed City-Oscoda	1	27
Grant-Clare	2	10
Freeman-Redding	143	7,219
Hamilton-Clare	1	0
Winterfield-Clare	3	110
Beaverton-Grout	25	531
Buckeye—North and South	288	1,907
Edenville	26	233
Bentley	35	266
Secord-Gladwin	2	0
Ogemaw County	233	1,169
Adams-Arenac	29	3,081
Clayton-Arenac	50	943
Monitor-Bay County	7	127
Tuscola County	4	0
Saginaw City	51	61
Birch Run	25	25
Dundee-Monroe	18	260
Crystal and Wyman	34	237
Amble-Montcalm	3	164
Muskegon	56	55
Holland-Zeeland	3	32
Allegan—all pools	522	4,773
Walker-Wyoming-Tallmadge	473	5,266
Van Buren—all pools	293	2,877
Barry County	1	9
Total	3,027	38,002

Crude Storage Provided

WINNIPEG, Man.—North Star Oil Co. is providing 80,000 bbl. storage largely for Turner Valley crude, which will be stored in the winter months to meet the heavier summer demand. Steel tanks 117 ft. in diameter and 47 ft. high will be used.

Federal Board Asks Authority To Curb Use of Natural Gas

(Continued from Page 57)

A brief outline of the physical characteristics of the industry is necessary to an understanding of the problems involved in its regulation.

In 1938 the marketed production of natural gas came overwhelmingly from the Mid-Continent and Gulf Coast areas, as shown in the following compilation by the Bureau of Mines:

MARKETED NATURAL-GAS PRODUCTION

	Millions of cu. ft.	Per cent
Appalachian area: Kentucky, New York, Ohio, Pennsylvania, Tennessee, and West Virginia	331.717	14.5
Illinois-Indiana-Michigan area	12,633	0.5
Midcontinent and Gulf Coast area: Arkansas, Kansas, Oklahoma, Louisiana, and Texas	1,516,040	66.0
Rocky Mountain area: Colorado, New Mexico, Montana, Utah, and Wyo.	104,781	4.6
California area	315,168	13.7
All other areas	15,223	0.7
Total	2,295,562	....

Estimates have been made by various authorities of the known natural-gas reserves in the United States. These estimates indicate a total reserve of from 60 to 75 trillion cubic feet of natural gas. The generally accepted figure is 66 trillion cubic feet, segregated as follows:

	Trillion cu. ft.
Central and southern states	51.5
California	7.0
Eastern states	6.0
Rocky Mountain states	1.5
Total	66.0

The formal work of the commission in the field of natural-gas regulation since the passage of the act has been divided between the handling of:

1. Twenty-three complaints relative to the rates and charges of natural-gas companies involving natural-gas properties aggregating in excess of $800,000,000. These complaints involve almost all of the major systems of the country.

2. Ten applications for certificates of convenience and necessity involving the granting of permission for the construction of new pipe lines for the transportation of natural gas into market areas of other natural-gas companies.

3. Seven applications for a determination by the commission of its jurisdiction over particular natural-gas operations.

The commission's work in connection with a major rate case may be briefly summarized as follows:

1. *Operating data.*—Each case requires a thorough analysis of the operations of the company, including an investigation of the loads, demands, production, purchases, transportation, and sales. On the basis of these data the commission's staff is able to forecast the company's future operations.

2. *Physical property.*—The commission's staff is required to make field surveys to determine the amount of property, the extent to which it is used or useful in the public service, and its physical condition.

3. *Gas reserves.*—As the natural-gas industry is an extractive industry, one of the important elements of cost which must be determined pertains to the exhaustion of the service life of the properties due to the depletion of the natural-gas reserves which the properties were constructed to produce or transport. The commission's geologists have been engaged in estimating the volume of gas reserves in a number of important fields, among them the Panhandle field in Texas, the Hugoton field in Kansas and a major portion of the fields located in West Virginia, Pennsylvania, and New York. A few years' difference in the estimated life of available gas reserves supplying a given market may make a large difference in the rates which can be justified for that area.

Summary of Operations, All Fields for February

SUMMARY OF COMPLETIONS

District—	Comp.	Oil	Prod.	Gas	Dry	Completions Under 1,000 ft.	1,000-2,500 ft.	2,500-5,000 ft.	5,000-10,000 ft.	Over 10,000 ft.	Footage	Drilling
Appalachian	389	295	395	67	27	12	326	46	5	0	727,982	482
Ohio	96	17	541	55	24	24	33	37	2	0	194,175	214
E. Kentucky	24	7	125	12	5	9	12	3	0	0	42,165	62
W. Kentucky	20	6	430	0	14	10	9	1	0	0	31,670	33
Michigan	76	28	10,532	3	45	4	50	22	0	0	155,649	104
Indiana	25	13	1,853	3	9	4	8	13	0	0	49,971	75
Illinois	210	145	23,702	0	65	15	70	124	1	0	491,994	330
Kansas	112	84	102,820	3	25	1	9	102	0	0	358,632	191
Nebraska	3	1	450	0	2	0	2	1	0	0	7,680	31
Missouri	0	0	0	0	0	0	0	0	0	0	0	4
Oklahoma	103	51	14,657	16	36	9	28	56	10	0	311,215	244
North Texas	151	100	25,939	1	50	46	46	49	10	0	342,608	238
W. Central Texas	49	19	3,057	5	25	9	33	7	0	0	88,309	62
Northwest Texas	71	67	49,843	0	4	0	7	9	55	0	332,125	160
Southwest Texas	57	55	58,619	0	2	0	10	46	1	0	198,111	131
Texas Panhandle	33	29	9,558	4	0	0	3	30	0	0	100,709	94
East Texas	63	52	5,424	1	10	0	0	57	6	0	249,378	72
E. Texas Border	8	1	36	2	5	0	4	2	2	0	28,293	10
Upper Gulf Coast	97	77	21,500	2	18	2	4	5	81	5	626,209	112
Lower Gulf Coast	60	43	4,739	3	14	0	0	10	50	0	353,139	82
South Texas	63	33	4,440	4	26	2	21	37	3	0	181,901	65
S. Central Texas	15	8	585	0	7	7	2	5	1	0	30,323	48
Southeast New Mexico	15	12	4,784	1	2	1	1	13	0	0	47,547	69
Arkansas	11	6	514	0	5	0	4	4	3	0	41,335	20
N. Louisiana	41	24	2,557	6	11	1	24	6	10	0	134,001	43
Louisiana Gulf	60	47	10,368	1	12	0	4	5	36	15	481,070	132
Mississippi	9	8	5,084	0	1	0	0	4	5	0	43,274	21
Alabama	1	0	0	0	1	1	0	0	0	0	445	2
Montana	19	7	1,268	7	5	3	8	8	0	0	37,386	59
Wyoming	10	9	8,351	0	1	0	3	2	5	0	33,293	76
Colorado	6	4	27	1	1	1	4	1	0	0	8,499	35
Utah	0	0	0	0	0	0	0	0	0	0	0	7
Northwest New Mexico	1	0	0	1	0	0	1	0	0	0	1,886	14
California	69	57	52,382	0	12	0	5	23	31	10	452,465	151
Iowa	0	0	0	0	0	0	0	0	0	0	0	6
Total February	1,967	1,305	424,580	195	464	161	731	728	317	30	6,243,439	3,478
Total January	2,262	1,551	510,036	212	499	158	753	973	349	29	7,170,910	3,348
Difference	295	246	85,444	14	35	3	22	245	32	1	927,471	130

APPALACHIAN

Field—	Comp.	Oil	Prod.	Gas	Dry	Dlg.
Bradford	*214	214	253	0	0	210
Allegany	*63	63	84	0	0	49
N. Oriskany	7	0	0	2	5	7
Middle dist.	15	13	13	2	0	10
Butler-Armstrong	3	1	1	1	1	10
S. W. Pa.	31	0	0	23	8	53
W. Virginia	56	4	44	39	13	143
Ttl. Feb.	389	295	395	67	27	482
Ttl. Jan.	343	256	351	71	16	354
Difference	46	39	44	4	11	128

*Includes water-intake wells.

OHIO

Field—	Comp.	Oil	Prod.	Gas	Dry	Dlg.
Ashland	4	0	0	3	1	6
Athens	11	3	11	4	4	16
Belmont	2	0	0	1	1	1
Cuyahoga	2	0	0	1	1	2
Guernsey	2	0	0	2	0	5
Knox	10	0	0	7	3	15
Lawrence	2	0	0	2	0	6
Licking	11	0	0	10	1	26
Lorain	3	1	2	0	2	6
Medina	8	3	15	1	4	10
Meigs	4	0	0	3	1	13
Monroe	5	1	1	4	0	5
Morgan	2	0	0	2	0	3
Muskingum	3	1	65	2	0	12
Noble	4	2	9	2	0	11
Perry	5	4	337	0	1	8
Stark	2	0	0	2	0	9
Tuscarawas	2	0	0	2	0	8
Washington	8	1	1	4	3	16
Miscellaneous	6	1	100	3	2	37
Ttl. Feb.	96	17	541	55	24	214
Ttl. Jan.	122	31	932	53	38	218
Difference	26	14	391	2	14	4

Gas: 32 million cu. ft. Input wells 12.

EASTERN KENTUCKY

Field—	Comp.	Oil	Prod.	Gas	Dry	Dlg.
Floyd	6	1	10	5	0	17
Martin	5	2	75	2	1	3
Knott	1	0	0	1	0	12
Pike	6	0	0	4	2	19
Powell	3	3	35	0	0	3
Greenup	1	1	5	0	0	0
Elliott	1	0	0	0	1	0
Morgan	1	0	0	0	1	2
Miscellaneous	0	0	0	0	0	6
Ttl. Feb.	24	7	125	12	5	62
Ttl. Jan.	24	11	76	9	4	61
Difference	0	4	49	3	1	1

Production of above gas wells, combined, 7,566,000 cu. ft.

WESTERN KENTUCKY

Field—	Comp.	Oil	Prod.	Gas	Dry	Dlg.
Butler	1	1	15	0	0	1
Daviess	6	2	230	0	4	13
Grayson	1	0	0	0	1	0
Hancock	2	0	0	0	2	0
Henderson	1	0	0	0	1	3
Larue	1	0	0	0	1	0
McLean	3	1	100	0	2	3
Muhlenberg	1	0	0	0	1	2
Ohio	2	1	10	0	1	5
Union	1	0	0	0	1	0
Webster	1	1	75	0	0	1
Miscellaneous	0	0	0	0	0	5
Ttl. Feb.	20	6	430	0	14	33
Ttl. Jan.	27	12	1,020	1	14	34
Difference	7	6	590	1	0	1

MICHIGAN

Field—	Comp.	Oil	Prod.	Gas	Dry	Dlg.
Allegan	18	6	385	0	12	26
Arenac	4	4	8,632	0	0	7
Bay	1	1	64	0	0	1
Berrien	1	0	0	0	1	2
Cheboygan	1	0	0	0	1	1
Clare	6	3	397	0	3	8
Eaton	1	0	0	0	1	0
Gladwin	1	0	0	0	1	1
Gratiot	2	0	0	1	1	0
Huron	3	0	0	0	3	1
Isabella	2	0	0	1	1	4
Kalkaska	1	0	0	0	1	1
Kent	1	0	0	0	1	3
Manistee	1	0	0	0	1	0
Midland	3	1	151	0	2	2
Montcalm	2	0	0	0	2	4
Muskegon	2	0	0	0	2	2
Ottawa	16	10	723	1	5	11
Oceana	1	0	0	0	1	1
Roscommon	1	0	0	0	1	1
St. Joseph	1	0	0	0	1	0
Van Buren	6	3	180	0	3	8
Miscellaneous	0	0	0	0	0	19
Ttl. Feb.	76	28	10,532	3	45	104
Ttl. Jan.	67	29	3,954	3	35	122
Difference	9	1	6,578	0	10	18

Million cu. ft. gas: Gratiot 8.34, Isabella 2.1, Ottawa 0.78.

INDIANA

Field—	Comp.	Oil	Prod.	Gas	Dry	Dlg.
Bowman	1	1	38	0	0	0
East Calvin	1	1	185	0	0	2
Griffin and South	7	7	1,360	0	0	18
Heusler	1	1	72	0	0	2
Oaktown	1	0	0	0	1	0
Point	2	2	195	0	0	2
Rockport	1	0	0	1	0	0
Sullivan	1	0	0	1	0	0
Trenton	1	1	3	0	0	0
Wildcat	9	0	0	1	8	41
Miscellaneous	0	0	0	0	0	10
Ttl. Feb.	25	13	1,853	3	9	75
Ttl. Jan.	38	25	3,116	5	8	63
Difference	13	12	1,263	2	1	12

Million cu. ft. gas: Rockport 14.2, Sullivan 1.0, wildcats 0.14.

ILLINOIS

Field—	Comp.	Oil	Prod.	Gas	Dry	Dlg.
Aden, North	1	1	40	0	0	0
Bartelso	1	1	10	0	0	0
Belle Prairie	1	1	215	0	0	0
Benton	2	2	752	0	0	4
Boyleston	2	2	180	0	0	1
Bridgeport	1	0	0	0	1	0
Centerville	1	1	91	0	0	0
Clay City	3	3	676	0	0	1
Dubois	1	1	30	0	0	0
Dundas	3	2	256	0	1	4
East Calvin	28	27	5,091	0	1	29
Enterprise and West	5	4	1,050	0	1	2
Fairman	4	3	538	0	1	2
Griffin and N. and S.	5	4	447	0	1	1
Herald	1	1	115	0	0	1
Hoodville	23	23	4,029	0	0	14
Inman	2	0	0	0	2	0
Keensburg	1	1	7	0	0	0
Linn	1	1	50	0	0	1
Louden	12	11	1,380	0	1	12
Martinsville	1	1	20	0	0	0
Mason	1	0	0	0	1	4
Maud	2	2	347	0	0	7
McKinley	4	4	320	0	0	1
Mill Shoals	1	1	125	0	0	3
Mount Carmel	11	10	2,478	0	1	23
New Harmony and North and South	9	8	1,586	0	1	15
Noble and North	4	4	80	0	0	2
North Boos	1	1	89	0	0	0
Omaha	2	2	127	0	0	1
Phillipstown	1	1	14	0	0	0
Roaches	1	1	40	0	0	0
Robinson	1	0	0	0	1	0
Salem	1	1	65	0	0	19
Sandoval	1	1	750	0	0	0
St. James	1	1	65	0	0	0
Southwest Barnhill	2	0	0	0	2	0
Springerton	1	1	10	0	0	0
Storms	4	4	577	0	0	9
Waterloo	1	1	10	0	0	0
West Irons	2	2	327	0	0	0
West Liberty	5	5	1,492	0	0	7
Wildcat	55	5	230	0	50	101
Miscellaneous	0	0	0	0	0	65
Ttl. Feb.	210	145	23,702	0	65	330
Ttl. Jan.	249	186	40,520	1	62	342
Difference	39	41	16,818	1	3	12

KANSAS

Field—	Comp.	Oil	Prod.	Gas	Dry	Dlg.
Atherton	1	1	158	0	0	0
Augusta	3	3	82	0	0	2
Beaver	1	0	0	0	1	2
Bedford	1	1	3,000	0	0	1
Bemis-Shutts	7	7	17,147	0	0	7
Big Creek and South	0	0	0	0	0	4
Bloomer	2	2	3,505	0	0	3
Bornholdt	3	3	156	0	0	5
Breford	2	2	3,391	0	0	0
Burnett	2	1	250	0	1	7
Burrton	1	1	48	0	0	6
Cairo	1	0	0	1	0	0
Canton, North	1	1	45	0	0	0
Couch	1	1	46	0	0	2
Cunningham	1	1	792	0	0	3
David, South	1	0	0	0	1	1
Demaiorie-Sowder	1	1	117	0	0	0
Dopita	1	1	599	0	0	1
Douglas	0	0	0	0	0	5
Edwards	4	4	5,839	0	0	5
El Dorado	1	1	41	0	0	0
Emmeram, North	1	1	647	0	0	0
Feltes	2	1	162	0	1	1
Geneseo	6	6	5,903	0	0	3
Hall-Gurney	9	9	12,268	0	0	20
Hagen	1	1	339	0	0	0
Hartsook	1	0	0	0	1	0
Holcomb Gas	1	0	0	1	0	0
Keesling	1	0	0	0	1	1
Keller	0	0	0	0	0	4
Kraft	1	1	2,046	0	0	4
Laton	3	3	2,245	0	0	2
Lost Springs	0	0	0	0	0	10
Orth and East	3	2	568	0	1	0
Potwin	1	1	75	0	0	0
Prusa	3	3	3,567	0	0	1
Ray	2	1	3,000	0	1	0
Ritz-Canton	1	0	0	0	1	0
Severy	1	1	135	0	0	4
Silica	4	4	4,672	0	0	9
Stafford	3	3	3,442	0	0	0
Stevens	1	0	0	1	0	2
Stoltenberg	3	3	2,926	0	0	5
Trapp	5	5	10,371	0	0	5
Virgil	1	0	0	0	1	1
Whelan	1	0	0	0	1	0
Wherry	1	0	0	0	1	1
Wilkins	2	2	3,205	0	0	5
Zenith	6	6	12,033	0	0	9
Misc.	1	0	0	0	1	18
Wildcats	12	9	0	0	12	32
Ttl. Feb.	112	84	102,820	3	25	191
Ttl. Jan.	156	128	104,912	4	34	217
Difference	44	44	2,092	1	9	26

OKLAHOMA

Field—	Comp.	Oil	Prod.	Gas	Dry	Dlg.
Allen	1	1	7	0	0	2
Altus	6	5	134	0	1	8
Beebe and North	2	1	70	0	1	8
Billings	2	0	0	0	2	0
Bristow and North	2	1	5	0	1	5
Cement	4	2	331	2	0	8
Chickasha	0	0	0	0	0	4
Coyle	2	1	50	0	1	1
Cromwell and East	1	1	385	0	0	5
Cumberland	1	1	907	0	0	9
Davenport, West	1	1	73	0	0	0
Dill	4	4	1,422	0	0	13
Doyle	1	1	30	0	0	2
Drumright	1	0	0	0	1	0
Earlsboro and East and West	1	1	125	0	0	1
Ed Cox	1	1	17	0	0	1
Empire	2	2	135	0	0	2
Francis, West	1	0	0	1	0	1
Frederick and West	3	1	3,305	0	2	2
Garr	1	1	56	0	0	0
Gray	1	0	0	0	1	0
Hazel	1	0	0	0	1	1
Healdton	2	1	34	0	1	0
Hewitt and West	2	2	447	0	0	17
Hobart	2	1	1,322	0	1	6
Holdenville	1	0	0	0	1	0
Kellyville	2	0	0	2	0	0
Keystone	2	0	0	2	0	0
Knox	1	1	20	0	0	2
Konawa, West and South	2	2	1,225	0	0	0
Laffoon	4	0	0	4	0	3
Little River district	2	2	344	0	0	6
Lovell and South	1	0	0	1	0	3
Oakman	1	1	20	0	0	0
Oklahoma City	1	1	746	0	0	9
Prague	4	3	390	0	1	0
Romulus	0	0	0	0	0	5
Sasakwa	1	0	0	0	1	0
St. Louis	8	8	2,583	0	0	7
Seminole	1	0	0	0	1	6
South Isom Springs	1	1	1	0	0	0
Terlton	1	0	0	1	0	0
Tussy	1	1	350	0	0	3
Velma	1	1	3	0	0	1
Weleetka, West	1	0	0	1	0	1
Wilzetta	1	1	120	0	0	0
Miscellaneous	1	0	0	1	0	54
Wildcats	20	0	0	1	19	48
Ttl. Feb.	103	51	14,657	16	36	244
Ttl. Jan.	129	86	16,877	10	33	288
Difference	26	35	2,220	6	3	44

NORTH CENTRAL TEXAS

NORTH TEXAS

Field—	Comp.	Oil	Prod.	Gas	Dry	Dlg.
Antelope	2	2	625	0	0	2
Archer	11	5	334	0	6	6
Baylor	1	1	80	0	0	2
Bloodworth	6	3	335	0	3	3
Bonita	2	2	4,010	0	0	3
Bryson	6	6	2,831	0	0	5
Clay	13	9	309	0	4	20
Cooke	4	3	27	0	1	6
Fargo	1	1	500	0	0	1
Griffin	1	1	1,200	0	0	1
Hapgood	1	0	0	0	1	0
Hull-Silk	8	8	4,674	0	0	26
Jack	1	0	0	0	1	3
K.M.A.	10	7	2,384	0	3	28
K.M.A. deep	2	2	1,028	0	0	1
Mathis	1	1	850	0	0	1
Nocona	3	2	45	0	1	2
Olney	18	13	753	0	5	12

Field—	Comp.	Oil	Prod.	Gas	Dry	Dig.
Ringgold	1	0	0	0	1	0
Rogers & Rogers	2	2	1,020	0	0	4
Seymour	1	1	58	0	0	2
T.C.U.	2	2	58	0	0	6
Throckmorton	1	0	0	0	1	2
Voth	7	7	1,610	0	0	7
Walnut Bend	5	5	1,442	0	0	8
Wichita	6	6	227	0	0	10
Wilbarger	3	2	55	0	1	5
Young	4	4	1,295	0	0	12
Wildcats	28	5	189	1	22	51
Miscellaneous	0	0	0	0	0	9
Total	151	100	25,939	1	50	238

WEST CENTRAL TEXAS

Akard	2	2	530	0	0	2
Albany	2	0	0	0	2	2
Brownwood gas	2	0	0	2	0	1
Caddo	1	0	0	0	1	0
Cook	1	1	95	0	0	3
Davis	2	2	31	0	0	1
Dibrell	1	1	4	0	0	0
Eastland	1	1	15	0	0	2
Hamby	1	0	0	0	1	0
Higgs	1	1	36	0	0	0
Hendrick gas	1	0	0	1	0	0
Ivy	1	0	0	0	1	0
Lewis	3	2	470	0	1	4
Loving	1	1	124	0	0	0
Moran	1	0	0	0	1	2
Newell	2	2	26	0	0	1
Santa Anna gas	1	0	0	1	0	1
Shackelford	1	0	0	0	1	2
Sayles	4	4	762	0	0	3
Snyder	1	0	0	0	1	0
S. Carbon	1	1	855	0	0	4
Stith	1	0	0	0	1	2
View and South	1	1	109	0	0	1
Wildcats	16	0	0	1	15	23
Miscellaneous	0	0	0	0	0	8
Total	49	19	3,057	5	25	62
Ttl. Feb.	200	119	28,996	6	75	300
Ttl. Jan.	209	135	49,627	3	71	309
Difference	9	16	20,631	3	4	9

WEST TEXAS

NORTHERN WEST TEXAS

Cedar Lake	2	1	402	0	1	2
Dockery & Robbins	4	4	1,111	0	0	6
Seminole	12	12	7,241	0	0	24
Sharon	4	3	299	0	1	5
Slaughter-Duggan	25	25	20,850	0	0	66
Wasson	22	22	19,940	0	0	41
Wildcats	2	0	0	0	2	10
Misc.	0	0	0	0	0	6
Total	71	67	49,843	0	4	160

SOUTHERN WEST TEXAS

Dunes	1	1	302	0	0	0
Foster	2	2	859	0	0	5
Goldsmith and North	7	7	6,560	0	0	12
Hendrick	1	1	102	0	0	0
Hutchins	2	2	1,112	0	0	2
Johnson	4	4	3,015	0	0	7
Jordan	3	3	845	0	0	6
Keystone	4	4	898	0	0	7
McCamey	1	1	243	0	0	2
McElroy	4	4	9,060	0	0	7
North Cowden	7	6	5,356	0	1	6
O'Brien	3	3	1,114	0	0	5
Pecos Valley	1	1	139	0	0	1
Sand Hills Permian	2	2	3,696	0	0	4
S. Magnolia-Sealy	1	1	678	0	0	2
Taylor-Link	2	2	466	0	0	1
Waddell	3	3	22,569	0	0	5
Ward	2	2	719	0	0	3
White & Baker	4	4	656	0	0	2
Wildcats*	3	2	230	0	1	25
Miscellaneous	0	0	0	0	0	29
Total	57	55	58,619	0	2	131
Ttl. Feb.	128	122	108,462	0	6	291
Ttl. Jan.	158	143	116,027	3	12	309
Difference	30	21	7,565	3	6	18

*Embar and Bean discoveries.

TEXAS PANHANDLE

Borger	8	8	3,756	0	0	26
Kellerville	2	2	272	0	0	2
Lefors	1	1	117	0	0	3
Magic City	1	1	104	0	0	3
Pampa	8	8	882	0	0	27
Shamrock	3	0	0	3	0	7
Skellytown	4	4	481	0	0	10
Stinnett	6	5	3,946	1	0	16
Ttl. Feb.	33	29	9,558	4	0	94
Ttl. Jan.	43	40	7,972	0	3	81
Difference	10	11	1,586	4	3	13

EASTERN TEXAS

East Texas*						
Longview	12	11	595	0	1	12
Kilgore	23	23	759	0	0	14
Joiner	5	5	218	0	0	5
Hawkins	2	2	706	0	0	5
Long Lake	2	2	378	0	0	4
Opelika	1	0	0	1	0	1
Richland	1	1	27	0	0	1
Talco	8	7	2,205	0	1	3
Tehuacana	1	0	0	0	1	1
Van	1	1	536	0	0	0
Wildcats	7	0	0	0	7	16
Miscellaneous	0	0	0	0	0	10
Ttl. Feb.	63	52	5,424	1	10	72
Ttl. Jan.	107	83	11,299	4	20	89
Difference	44	31	5,875	3	10	17

*East Texas field production by hour.

EAST TEXAS BORDER

Caddo	1	0	0	0	1	0
Carthage	0	0	0	0	0	1
Joaquin	1	0	0	1	0	2
Smithland	2	1	36	0	1	2
Waskom	1	0	0	1	0	0
Wildcats	3	0	0	0	3	5
Ttl. Feb.	8	1	36	2	5	10
Ttl. Jan.	4	3	72	0	1	11
Difference	4	2	36	2	4	1

Gas production (million cu. ft. open flow): Joaquin 116, Waskom 42.

TEXAS GULF COAST

Anahuac	3	2	898	0	1	2
Barbers Hill	1	1	298	0	0	1
Batson	1	1	13	0	0	0
Big Creek	1	1	30	0	0	0
Blessing	1	1	148	0	0	1
Buckeye	1	0	0	0	1	0
Capien	1	1	357	0	0	1
Chenango	1	1	453	0	0	1
Dyersdale	2	2	310	0	0	1
Dickinson	2	1	426	1	0	1
Esperson	1	1	324	0	0	3
Fannett	3	3	2,311	0	0	3
Fairbanks	3	3	295	0	0	2
Hamman	1	1	177	0	0	1
Hardin	1	1	317	0	0	1
Hillje	2	0	0	1	1	0
Humble	3	3	220	0	0	2
La Ward	2	2	998	0	0	1
Lolita	9	9	2,129	0	0	6
League City	1	1	234	0	0	1
Lovells Lake	1	0	0	0	1	1
Magnet	2	2	172	0	0	1
Manvel	1	1	431	0	0	0
N. Markham	1	1	254	0	0	1
Old Ocean	4	4	1,357	0	0	12
Port Neches	2	1	125	0	1	2
Red Fish Reef	1	1	144	0	0	4
Rowan	1	1	21	0	0	1
Seabreeze	1	1	167	0	0	1
Segno	1	1	414	0	0	2
Sour Lake	1	0	0	0	1	0
South China	1	1	167	0	0	1
South Liberty	1	0	0	0	1	2
Thompson	2	2	304	0	0	3
Tomball	4	3	246	0	1	1
Van Vleck	1	1	271	0	0	1
W. Beaumont	1	1	116	0	0	1
West Ranch	12	11	4,987	0	1	13
West Ganado	1	1	4	0	0	0
W. Columbia	5	4	1,893	0	1	2
Withers	5	5	489	0	0	4
Miscellaneous	8	0	0	0	8	31
Ttl. Feb.	97	77	21,500	2	18	112
Ttl. Jan.	75	62	22,830	2	11	117
Difference	22	15	1,330	0	7	5

LOWER TEXAS GULF COAST

Alice	1	1	51	0	0	0
Agua Dulce	3	3	515	0	0	8
Ben Bolt	1	1	334	0	0	1
Clara Driscoll	5	4	393	0	1	5
Coleto Creek	2	1	30	0	1	2
East White Point	3	3	314	0	0	2
Fagan	1	1	58	0	0	2
Henshaw	1	0	0	0	1	0
Heyser	2	2	129	0	0	1
La Gloria	2	0	0	2	0	4
Luby	1	1	150	0	0	0
McCampbell	1	1	102	0	0	1
McFaddin	1	0	0	0	1	2
Midway	4	4	307	0	0	5
North Keeran	1	0	0	0	1	0
Placedo	1	1	15	0	0	1
Orange Grove	1	1	144	0	0	1
Richard King	2	2	162	0	0	2
Premont	1	0	0	0	1	0
Sandia	1	1	24	0	0	0
Shield	1	1	118	0	0	0
South Clara Driscoll	1	1	52	0	0	2
Stratton	10	8	901	1	1	10
Thomaston	1	0	0	0	1	0
Tomoconnor	1	1	104	0	0	1
Victoria	1	0	0	0	1	1
Wade City	6	5	836	0	1	3
Miscellaneous	4	0	0	0	4	28
Ttl. Feb.	60	43	4,739	3	14	82
Ttl. Jan.	61	43	6,199	2	16	89
Difference	1	0	1,460	1	2	7

SOUTH TEXAS

Boyle	3	0	0	1	2	1
Bridwell	1	1	198	0	0	1
Calliham	1	0	0	1	0	1
Casa Blanca	2	1	75	0	1	1
Cedro Hill	4	3	84	0	1	1
Charco Blanco	1	0	0	0	1	0
Cole	1	0	0	0	1	1
Colorado	7	7	776	0	0	4
Charamousca	3	1	28	0	2	1
Driscoll	1	1	273	0	0	1
Glen	3	3	529	0	0	3
Hoffman	2	2	92	0	0	3
Holbein	1	1	50	0	0	1
Kelsey	5	4	393	0	1	3
Killam	1	1	60	0	0	0
Lopeno	2	0	0	2	0	1
Manila	2	1	960	0	1	1
North Rincon	1	1	200	0	0	0
Nichols	1	1	124	0	0	2
Rincon	2	2	471	0	0	2
Rio Grande City	1	1	52	0	0	1
Samfordyce	1	1	63	0	0	1
South Calliham	1	0	0	0	1	0
White Creek	1	1	12	0	0	2
Miscellaneous	15	0	0	0	15	33
Ttl. Feb.	63	33	4,440	4	26	65
Ttl. Jan.	76	33	2,623	7	36	56
Difference	13	0	2,817	3	10	9

SOUTH CENTRAL TEXAS

Bee Creek	1	1	261	0	0	1
Chicon Lake	1	0	0	0	1	1
Elm Creek	4	3	13	0	1	4
Gas Ridge	2	2	4	0	0	3
Pearsall	1	1	87	0	0	3
Tinney Creek	1	1	220	0	0	4
Miscellaneous	5	0	0	0	5	32
Ttl. Feb.	15	8	585	0	7	48
Ttl. Jan.	21	11	1,185	0	10	42
Difference	6	3	600	0	3	6

SOUTHEAST NEW MEXICO

Arrowhead	1	0	0	1	0	2
Dayton	1	1	5	0	0	3
Eaves	1	1	1,200	0	0	2
Halfway	1	1	255	0	0	1
Leonard	1	1	312	0	0	3
Loco Hills	2	1	360	0	1	5
Maljamar	6	6	2,572	0	0	19
Skelly	1	1	80	0	0	1
Wildcats	1	0	0	0	1	14
Miscellaneous	0	0	0	0	0	19
Ttl. Feb.	15	12	4,784	1	2	69
Ttl. Jan.	28	20	5,393	1	7	80
Difference	13	8	609	0	5	11

ARKANSAS

Buckner	1	1	13	0	0	0
Dorcheat	1	1	288	0	0	1
El Dorado	1	0	0	0	1	3
Magnolia	1	0	0	0	1	0
Smackover	3	3	193	0	0	5
Troy	1	1	20	0	0	0
Miscellaneous	0	0	0	0	0	8
Wildcats	3	0	0	0	3	3
Ttl. Feb.	11	6	514	0	5	20
Ttl. Jan.	14	5	1,588	0	9	22
Difference	3	1	1,074	0	4	2

NORTH LOUISIANA

Athens	1	0	0	1	0	0
Bellevue	1	0	0	1	0	0
Bisteneau	1	0	0	1	0	0
Bull Bayou	1	0	0	0	1	0
Caddo	14	12	455	0	2	12
Converse	1	1	25	0	0	2
Cotton Valley	2	1	926	1	0	1
Homer	1	1	60	0	0	1
Lisbon	1	0	0	0	1	1
Monroe	1	0	0	1	0	1
Nebo	3	3	345	0	0	2
Olla	7	6	746	0	1	4
Sugar Creek	1	0	0	1	0	1
Miscellaneous	0	0	0	0	0	6
Wildcats	6	0	0	0	6	12
Ttl. Feb.	41	24	2,557	6	11	43
Ttl. Jan.	49	25	4,566	9	15	58
Difference	8	1	2,009	3	4	15

Gas production (million cu. ft.): Athens 8, Bellevue 1, Bisteneau 56.5, Cotton Valley 3, Sugar Creek 14, Monroe 3.

LOUISIANA GULF COAST

Abbeville	1	1	38	0	0	0
Anse La Butte	4	3	530	0	1	7
Bayou Blue	2	2	288	0	0	3
Bayou de Allemands	1	1	76	0	0	1
Bateman Lake	1	0	0	1	0	0
Bayou Pigeon	1	1	334	0	0	1
Cameron Meadows	1	1	400	0	0	1
Chacahoula	1	0	0	0	1	3
Chalkley	2	2	172	0	0	2
Dog Lake	1	1	335	0	0	1
Eola	1	1	347	0	0	1
Garden Island	1	1	194	0	0	0
Golden Meadow	4	3	520	0	1	6
Grand Bay	1	1	292	0	0	2
Grand Lake	1	1	133	0	0	1
Happytown	1	0	0	0	1	0
Iowa	3	3	1,166	0	0	1
Jennings	2	2	326	0	0	4
Lake Mongoulois	1	0	0	0	1	1
Lake Long	1	1	175	0	0	1
Lowry	1	1	85	0	0	0
N. Crowley	1	1	436	0	0	1
Lake Pelto	1	0	0	0	1	0
Leeville	1	1	291	0	0	1
New Iberia	1	1	32	0	0	3
Port Barre	1	1	265	0	0	1
Potash	1	1	164	0	0	1
Raceland	1	0	0	0	1	0
Quarantine Bay	2	2	981	0	0	2
Schooner Bayou	2	2	697	0	0	0
South China	1	0	0	0	1	0
S. Roanoke	1	1	36	0	0	0
Sorrento	1	0	0	0	1	0
St. Gabriel	1	1	238	0	0	1
Sweet Lake	1	1	108	0	0	1
Valentine	1	1	116	0	0	1
Ville Platte	7	6	1,187	0	1	13
W. Hackberry	1	1	150	0	0	3
West Lake Verret	1	0	0	0	1	2
Woodlawn	1	1	256	0	0	2
Miscellaneous	1	0	0	0	1	64
Ttl. Feb.	60	47	10,368	1	12	132
Ttl. Jan.	83	58	13,867	2	23	140
Difference	23	11	3,499	1	11	8

MISSISSIPPI

Jackson	0	0	0	0	0	1
Tinsley	8	8	5,084	0	0	12
Wildcats	1	0	0	0	1	8
Ttl. Feb.	9	8	5,084	0	1	21
Ttl. Jan.	13	8	4,250	0	5	12
Difference	4	0	834	0	4	9

No active operations nor completions in Georgia or Florida in February.

ALABAMA

Ttl. Feb.	1	0	0	0	1	2
Ttl. Jan.	0	0	0	0	0	3
Difference	1	0	0	0	1	1

MONTANA

Bowes	1	0	0	1	0	0
Bowdoin	2	0	0	2	0	7
Cedar Creek	2	0	0	2	0	2
Cut Bank	8	6	1,119	0	2	11
Hardin	2	0	0	2	0	2
Kevin-Sunburst	3	1	149	0	2	14
Miscellaneous	1	0	0	0	1	23
Ttl. Feb.	19	7	1,268	7	5	59
Ttl. Jan.	27	17	2,809	8	2	54
Difference	8	10	1,541	1	3	5

WYOMING

Frannie	1	1	396	0	0	1
La Barge	2	2	62	0	0	4
Lance Creek	4	4	5,033	0	0	8
Mahoney	1	1	766	0	0	1
Salt Creek	1	0	0	0	1	0
Wertz	1	1	2,094	0	0	4
Miscellaneous	0	0	0	0	0	58
Ttl. Feb.	10	9	8,351	0	1	76
Ttl. Jan.	13	8	1,979	0	5	68
Difference	3	1	6,372	0	4	8

COLORADO

Huerfano	2	2	12	0	0	5
Moffat	1	0	0	1	0	3
Rio Blanco	3	2	15	0	1	4
Miscellaneous	0	0	0	0	0	23
Ttl. Feb.	6	4	27	1	1	35
Ttl. Jan.	2	2	45	0	0	38
Difference	4	2	18	1	1	3

UTAH

Ttl. Feb.	0	0	0	0	0	7
Ttl. Jan.	0	0	0	0	0	7
Difference	0	0	0	0	0	0

NORTHWEST NEW MEXICO

Fulcher Basin	1	0	0	1	0	1
Miscellaneous	0	0	0	0	0	13
Ttl. Feb.	1	0	0	1	0	14
Ttl. Jan.	1	0	0	0	1	15
Difference	0	0	0	1	1	1

CALIFORNIA

Aliso Canyon	1	1	840	0	0	0
Belridge, North	1	1	401	0	0	3
Coalinga and N.E. & S.E.	5	5	10,198	0	0	13
Coles Levee	1	1	520	0	0	6
Dominguez	1	1	1,120	0	0	0
Gato Ridge	1	1	100	0	0	0
Greeley	2	2	2,205	0	0	6
Huntington Beach	5	5	3,538	0	0	3
Kern River	1	1	140	0	0	2
Kettleman N. Dome	1	1	525	0	0	8
Oak Canyon	1	1	100	0	0	0
Padre Canyon	1	1	160	0	0	0
Paloma	1	1	1,220	0	0	1
Potrero	1	1	450	0	0	1
Rincon	2	2	322	0	0	1
Rio Bravo	4	4	5,190	0	0	5
Round Mountain	1	1	225	0	0	0
San Miguelito	1	1	444	0	0	1
Santa Fe Springs	1	1	140	0	0	1
Santa Maria Valley	1	1	1,304	0	0	2
Shiells Canyon	1	1	65	0	0	0
Ten Section	4	4	9,167	0	0	4
Tupman	4	4	2,625	0	0	5
Union Ave.	1	1	101	0	0	1
Ventura Ave.	3	3	4,358	0	0	8
Wasco	1	1	3,135	0	0	0
Wilmington	10	10	3,789	0	0	11
Miscellaneous	12	0	0	0	12	69
Ttl. Feb.	69	57	52,382	0	12	151
Ttl. Jan.	119	107	84,963	2	10	147
Difference	50	50	32,581	2	2	4

Cut Ordered in Rail and Pipe-Line Rates

(Continued from Page 71)

placed in a group the average distance of which from Tulsa is 595 miles. Its rate is 40 cents. Indianapolis, the most important consuming point in Indiana, 664 miles from Tulsa, is placed in a group the average distance of which from Tulsa is 686 miles. Its rate is 48 cents.

The commission's extensive report found that the rates assailed on gasoline, other refined petroleum products taking the same rates, and natural gasoline, in tank-car loads, to points in Indiana are and for the future will be unduly prejudicial of those points, and that points in Illinois are unduly preferred, to the extent that the contemporaneous rates from Oklahoma Group 3 to the following named Indiana points and points taking the same rates, exceed by more than the indicated amounts the contemporaneous rate from Oklahoma Group 3 to Effingham, Ill., and points taking the same rates:

Indiana points—	Excess over Effingham rate, cents per 100 lb.
Terre Haute	3
Indianapolis	6
Muncie	9
Fort Wayne	12

Rates from the other southwestern origin groups covered by the complaint shall be revised accordingly.

The shippers made a strong attack on the minimum tender requirements of 25,000 bbl. imposed by the gasoline pipe lines. The I.C.C. considered the evidence on this subject with much care, and concluded:

"We are convinced from the evidence that with a pipe line of this size the minimum of 25,000 bbl. is the practical operating minimum. But it does not follow that this is the reasonable minimum tender when reasonable restrictions are imposed. If tendered subject to delay in transit, smaller tenders are reasonable.

"Finding No. 4.—We further find that the minimum tender requirements of Great Lakes Pipe Line Co. and Phillips Petroleum Co., namely, 25,000 bbl., are reasonable when normal transportation service is demanded; that a reasonable minimum tender when gasoline or kerosene is offered for transportation subject to delay until defendants have accumulated at that receiving point 25,000 bbl. of the same specifications from the same or other shippers, is and for the future will be 5,000 bbl., and that any greater minimum tender requirement when so offered subject to delay is and for the future will be unreasonable, but that the time during which such shipments are thus necessarily stored at origin shall be deducted from the storage time now allowed at destination without additional charge and that the storage time at destination without additional charge shall be correspondingly reduced."

MISSISSIPPI AND SOUTHEAST

South Tinsley Development Reaches Record High

By GEORGE WEBER

JACKSON, Miss., Mar. 24.—Drilling activity in the Tinsley field of Yazoo County has risen to the highest point since its discovery. Operations are concentrated in the southeast and south sections of the field, where weekly extensions of production in the thick Woodruff sand section have created considerable leasing and outpost drilling.

During the past week, a total of 19 rigs were active on Tinsley locations, and new tests staked during the past 2 weeks indicate an even higher degree of activity. The extension of the field beyond original expectation has brought new operators into the drilling play. Among them are: J. P. Evans, Carl Jones, Love Petroleum Co., Sinclair Wyoming Oil Co. and Sylvan Producing Co. In addition, Hassie Hunt, E. C. Johnston and Union Producing Co., with production elsewhere in the field, are major operators in the current active area. Tinsley production has shown a slight reduction during the past 2 weeks, and averaged about 17,800 bbl. daily last week. Of the total of 136 oil wells in the field, 89 are on the pump, and 47 are flowing. Despite the low reservoir pressure, however, the field's estimated potential production is about 58,000 bbl. daily.

Wildcats

The success at Tinsley and lack of it elsewhere in the state have tended to subordinate wildcatting in importance this year. There are, however, several important tests drilling at this time, and indications point to a continuation of active exploration throughout this year. A total of six wildcats are now active in Clarke, Grenada, Lauderdale, Noxubee, Stone and Warren counties, and others are temporarily shut down.

In Grenada County, Grenada County Drilling & Development Co. 1 Connecticut General Life Insurance Co. blew out at 2,370 ft., blowing gas and mud 25 ft. into the derrick. The flow quickly died, and operators are drilling ahead below 2,410 ft.

Eastern Operations

Wildcatting is following the increase in geophysical and leasing work in Alabama and Georgia, with two new tests announced last week. In Wilcox County, southern Alabama, Reid Clark has staked location for 1 R. F. McWilliams, 200 ft. south, 400 ft. west of NE cor. NW SE 9-11-0. This will be a 5,000-ft. test, on which rig is moving this week.

Ellis & Hatten have moved a rotary rig to Dougherty County, Georgia, for a wildcat test to be drilled about 18 miles southwest of Albany. Elsewhere in the southeastern states, tests are drilling or temporarily inactive in Colbert, Fayette, Franklin and Madison counties, Alabama, Clinch County, Georgia, and Dade County, Florida.

Mellen & Gear have moved rig back onto 1 Alsobrook, drilling on the Bear Creek structure which extends across the Alabama-Mississippi line. They abandoned a test in Tishomingo County, Mississippi, about 3 miles to the southwest of the Alsobrook, in January, after good gas shows were encountered.

SUMMARY OF COMPLETIONS

	No.	Bbl.	Footage
Oil wells	2	957	9,818
Gas wells	1	*15	2,424
Total	3		12,242

*Million cu. ft.

MISSISSIPPI COMPLETIONS

Jackson—Hinds County

City of Canton 1 State, 200 ft. S Riverside Drive, 100 ft. E Peachtree St., 34-6n-1e, 15,000,000 cu. ft. gas, T.D. 2,424 ft., 5-in. casing 2,424 ft.

Tinsley—Yazoo County

Union Prod. 1 Jones-Berry unit, NW NE 25-10-3, 912 bbl., 24/64-in. choke, T.P. 120 lb., C.P. 160 lb., T.D. 4,910 ft., 7-in. casing 4,904 ft., Woodruff section 4,812-70 ft., perf. 4,850-74 ft.

Union Prod. 1-A Woodruff, SW NW 11-10-3, pumped 45 bbl., T.D. 4,920 ft., 7-in. casing 4,889 ft., Perry sand 4,892-4,908 ft., Woodruff sand missing.

MISSISSIPPI DRILLING REPORT

Clarke County

Walsingham & Earles 1 School Land, SW NW NE 16-4n-15e, drilling 3,835 ft., Tuscaloosa formation.

Grenda County

Grenada County Drlg. & Dev. 1 Conn. General, NW SE 28-23n-5e, gas blowout 2,370 ft., died, drilling 2,421 ft.

Kemper County

A. E. Manning 1 McKelvain, NE SE 2-9n-17e, S.D. 1,475 ft.

Lauderdale County

Magnolia 1 Culpepper, NW NE 4-8n-14e, rig.

Marshall County

C. B. Blosser 1 C. Stansback, SE SE 19-3s-4w, S.D. 655 ft.

Noxubee County

Fred Stewart (Hope & Thompson) 1 Donahoo, C NW 25-16n-17e, T.D. 2,212 ft., washing down.

Prentiss County

Home Dev. Co. 1 A. Allen, SW NW SE 8-7s-9e, S.D. 2,145 ft., rainbow oil.

Sharkey County

British American 1-A Houston, N½ NE SW 23-11-7w, rig.

Stone County

H. I. Morgan 2 Dantzler Lumber Co., NE SE 4-4s-10w, drilling 6,630 ft.

Warren County

Waggoner Bros. 1 Parker, NW NW 17-14n-1e, drilling 5,920 ft.

Winston County

Frame & Young 1 H. C. Chancellor, NE 9-13n-14e, S.D. 246 ft.

Yalobusha County

J. E. Green 1 Walter Goldman, SW SE NW 23-25-6e, S.D. 2,305 ft.

ALABAMA DRILLING REPORT

Colbert County

Mellen & Gear 1 Mrs. W. B. Alsobrook, C S½ SW NW 10-4s-15w, drilling 1,800 ft.

Fayette County

B. L. Fillingame 1 Ala. Educational Association, NW SW 3-16s-12w, rigging up heavier rig, T.D. 1,700 ft., bubbling gas from sand 1,541-51 ft.

Franklin County

E. O. Heath, Jr., 1 W. O. Hester, SW SW 4-6s-12w, T.D. 600 ft., moving in 10-in. casing.

Madison County

W. W. Newman 4 Nichols, 2-6s-2e, drilling 135 ft., St. Genevieve.

Wilcox County

Reid Clark et al 1 R. F. McWilliams, NE NW SE 9-11n-10e, first report.

CRUDE-OIL PRICES IN REPRESENTATIVE FIELDS

Complete crude-price schedules are now being published in the first issue of each month. The last complete schedule was published in the March 6 issue. All changes in crude-oil-price schedules will be published completely in the first issues following the announcement of the changes. Following are representative crude-price schedules in barrels (42 gal.):

East Texas	$1.10
Conroe	1.27
Tepetate, Louisiana	1.03
Smackover, Arkansas, heavy	.73
Illinois basin	1.15
Pecos County, Texas	.78
Lance Creek, Wyoming	.77
Bradford, Pennsylvania	2.15

Gravity Schedules

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

	Signal Hill, California*	Oklahoma, Kansas	Gulf Coast, Texas
14-14.9	$0.65	....	....
15-15.9	.65	....	....
16-16.9	.65	....	....
17-17.9	.65	....	....
18-18.9	.65	....	....
19-19.9	.69	....	$0.86
20-20.9	.73	$0.70	.88
21-21.9	.78	.72	.90
22-22.9	.82	.74	.92
23-23.9	.86	.76	.94
24-24.9	.90	.78	.96
25-25.9	.95	.80	.98
26-26.9	.99	.82	1.00
27-27.9	1.03	.84	1.02
28-28.9	1.07	.86	1.04
29-29.9	1.10	.88	1.06
30-30.9	1.14	.90	1.08
31-31.9	....	.92	1.10
32-32.9	....	.94	1.12
33-33.9	....	.96	1.14
34-34.9	....	.98	1.16
35-35.9	....	1.00	1.18
36-36.9	....	1.02	1.20
37-37.9	....	1.04	1.22
38-38.9	....	1.06	1.24
39-39.9	....	1.08	1.26
40-40.9	....	1.10	1.28

*Effective February 1, 1940.

NEXT STOP ST. LOUIS!
AND MY STOP IS HOTEL Mayfair!
TOPS IN FOOD & SERVICE - AND RIGHT DOWNTOWN
ALL ROOMS WITH BATH RADIO RECEPTION

MARKET RECORD OF ACTIVE OIL STOCKS . . .

Compiled by Carl H. Pforzheimer & Co., 25 Broad Street, New York City, Member New York Stock Exchange and New York Curb Exchange

New York Stock Exchange

1941 High	1941 Low	Week ended Mar. 22 High	Week ended Mar. 22 Low	Week ended Mar. 22 Close	Stocks—	Total shares outstanding	Par value	Latest dividend	Payable or last paid	Dividends paid in 1940	Com. sh. earn. 1939	Com. sh. earn. 1938	1940 High	1940 Low	1939 High	1939 Low
50⅝	44	48½	46¾	48½	Amerada Corp.	788,675	N.P.	50cQ	1-31-41	$2.00	$1.56	$2.07	58½	38½	74½	50
24¼	20¾	22⅛	21⅝	21⅞	Atlantic Refining	2,663,999	$25	25cQ	3-15-41	1.00	1.66	1.40	27⅛	18¼	24¾	18⅛
10½	8	9	8¾	8¾	Barber Asphalt Co.	390,223	$10	25c	5-21-40	.50	1.39	—.85	16⅝	8½	21	10¼
9⅝	7⅝	8½	8	8	Barnsdall Oil Co.	2,558,779	$5	15c	3-10-41	.60	.76	1.26	13⅜	7⅛	19½	11⅛
6	5⅜	5⅝	5⅜	5⅜	Consolidated Oil Corp.	13,751,726	N.P.	12½cQ	2-15-41	.72½	.55	.55	8⅛	5½	9⅞	6½
20½	17⅝	18¾	17¾	18	Continental Oil of Delaware	4,682,572	$5	25cQ	3-31-41	1.00	1.35	1.10	25	16⅛	31½	19⅞
4½	3½	3¾	3⅝	3⅝	Houston Oil	1,098,618	$25	....	10-17-30	....	.43	.83	6⅞	3⅜	9⅜	4½
11⅝	9¾	10½	10¼	10¼	Lion Oil Refining	435,815	N.P.	25cQ	4-15-41	1.00	1.50	2.09	14⅜	9	18⅛	10
15⅛	13⅜	14	13⅜	14	Mid-Continent Petroleum	1,857,912	$10	40c	12-2-40	.80	1.42	.56	17⅝	11½	18	11⅜
11	9⅜	9⅞	9½	9½	Mission Corporation	1,378,645	$10	25c	12-20-40	.25	.87	1.04	11¾	7⅛	14⅞	8¾
6⅝	4⅞	5½	5¼	5¼	National Supply	1,155,517	$10	....	12-22-37	....	—.87	—.79	9¾	4⅝	15½	5⅝
7⅞	6¾	7	6¾	6¾	Ohio Oil Co.	6,563,377	N.P.	25c	12-14-40	....	—.10	.25	8¾	5⅜	10½	6
7⅛	5½	6⅝	6⅜	6⅜	Pacific Western Oil	1,000,000	N.P.	40c	12-19-39	....	.81	1.22	8⅞	5½	11⅞	7
8½	7¼	7⅞	7¾	7¾	Pan American Pet. Trans.	4,702,945	$5	25c	12-21-40	.25	1.10	.08	10½	6¾	8¾	5
41¼	35¾	38¾	38	38¼	Phillips Petroleum	4,449,052	N.P.	50cQ	3-1-41	2.00	2.21	2.03	41¾	27⅛	46½	31¼
16⅞	14⅜	15	14⅝	14⅞	Plymouth Oil Co.	1,038,633	$5	30c	3-31-41	‡1.30	2.38	2.59	22¾	15	24	17⅛
8⅞	7	7⅞	7⅝	7⅝	Pure Oil Co.	3,982,031	N.P.	25c	12-20-40	.25	1.11	.38	11½	6¾	11¾	6⅛
9	7¼	8¾	8⅝	8¾	Richfield Oil Corp.	4,010,000	N.P.	50c	12-21-40	.50	.65	.51	9¼	5⅞	10¼	6⅝
15⅝	12½	13½	13¼	13¼	Seaboard Oil of Delaware	1,244,383	N.P.	25cQ	3-15-41	1.00	1.40	1.52	20	11	24⅜	15½
12⅜	10⅛	12¼	11¾	11⅞	Shell Union Oil	13,070,625	N.P.	50c	12-20-40	.75	.77	.72	13⅛	7⅝	17¼	9⅞
22⅜	18⅞	22	21¾	21¾	Skelly Oil	995,349	$15	50c	12-20-40	1.25	1.99	2.27	23¼	12¼	29½	15½
9¼	8¼	9	8⅝	8⅝	Socony-Vacuum	31,206,071	$15	25cSA	3-15-41	.50	1.10	1.29	12½	7⅛	15⅛	10¼
20¾	17⅞	19⅞	19	19¼	Standard Oil of California	13,003,953	N.P.	25cQ	3-15-41	1.00	1.38	2.22	26⅛	16¼	33⅝	24¼
27⅞	25½	26¼	25¾	25⅞	Standard Oil (Indiana)	15,272,020	$25	25c	3-15-41	1.50	2.23	1.82	29	20¾	30	22¾
36½	33	35½	35	35⅛	Standard Oil of New Jersey	27,280,998	$25	75c†	12-16-40	1.75	3.26	2.86	46½	29⅞	53½	38
40⅛	34¼	37⅞	36⅞	36⅞	Standard Oil of Ohio	753,740	$25	37½c	3-15-41	2.00	6.64	1.81	41¾	26¼	32¾	17
58¾	52	52½	52	52	Sun Oil	2,434,863	N.P.	25cQ§	3-15-41	*1.00	2.74	1.07	65⅞	46¾	66	45¾
1¾	1⅜	1⅝	1½	1½	Superior Oil Corp.	1,388,979	$1	10c	12-28-40	.10	.04	.24	2½	1⅛	3⅝	1¾
40¼	34½	36	35¼	35⅝	Texas Corp.	10,876,139	$25	50cQ	4-1-41	2.00	3.02	2.13	47⅝	33	50¾	32½
3⅜	2⅞	3⅜	3	3	Texas Gulf Producing Co.	888,147	N.P.	10c	12-14-40	.20	.69	.86	4¼	2½	5⅜	3¼
6	5¼	5½	5⅜	5⅜	Texas Pacific Coal & Oil	888,236	$10	10c	3-1-41	.40	1.00	1.16	8⅝	5⅜	11⅜	7
10⅜	9⅜	9⅝	9½	9⅝	Tide Water Associated	6,371,827	$10	15c	3-3-41	.70	1.05	1.28	12	8¾	14¼	9½
14½	12¾	13¼	13	13	Union Oil Co. of California	4,666,270	$25	25c	2-15-41	1.00	1.25	1.47	17½	12	19¾	15⅛
29¾	25⅝	28	27	27½	Union Tank Car Co.	1,177,381	N.P.	50c	3-3-41	1.75	2.07	1.16	29⅞	22¾	24¼	20⅛
1⅞	1⅝	1¾	1⅝	1⅝	Wilcox Oil & Gas	470,768	$5	10c	2-15-40	....	.77	.52	3⅝	1¾	4¼	2⅝

*Also 5 per cent in stock. †Includes extras. ‡Also 2 per cent in stock. §Also 6 per cent in stock. —Deficit.

New York Curb Exchange

1941 High	1941 Low	Week ended Mar. 22 High	Week ended Mar. 22 Low	Week ended Mar. 22 Close	Stocks—	Total shares outstanding	Par value	Latest dividend	Payable or last paid	Dividends paid in 1940	Com. sh. earn. 1939	Com. sh. earn. 1938	1940 High	1940 Low	1939 High	1939 Low
7	5⅛	5⅞	5⅝	5¾	American Republics Corp.	1,308,049	$10	25c	12-18-40	....	$0.14	—$0.22	10¾	4½	11¾	5⅛
1¾	1⅜	1½	1⅜	1½	Bridgeport Machine Co.	263,700	N.P.	$1.25	12-30-37	....	—.95	—.14	3¼	1⅜	7¼	2⅛
40¼	38	39½	39½	39½	Buckeye Pipe Line Co.	200,000	$50	$1	3-15-41	$4.00	3.13	2.36	43	28	34⅝	26⅛
110¼	103¾	105	105	105	Chesebrough Mfg. Co.	120,000	$25	$1.50Q†	3-31-41	6.00	7.87	5.32	117	95	130	108⅝
5⅛	3¾	4⅝	4½	4½	Cities Service (new)	3,703,978	$10	....	6-1-32	....	.68	.23	6¾	4	9¼	4¼
⅞	⅝	⅞	¾	¾	Cosden Petroleum	465,332	$1	....	.....	....	....	....	2⅛	⅝	2¼	⅛
15¼	12½	13¼	12⅞	13	Creole Petroleum	6,974,356	$5	50cSA†	12-16-40	1.00	1.38	1.64	24¼	11⅝	28	16⅜
4½	3⅝	4½	4½	4½	Darby Petroleum	351,390	$5	25cSA	1-15-39	....	.03	.69	4⅜	2⅞	7⅛	3⅝
1⅛	1	1	1	1	Derby Oil & Refining	263,162	N.P.	....	.....	....	—.37	—.91	2	¾	2⅝	1⅛
28⅜	21½	21¼	21¼	21¼	Eureka Pipe Line	50,000	$50	$3.50†	2-1-41	2.25	.63	—.37	31	20¼	23	15⅛
33½	30½	32⅜	30½	30⅝	Gulf Oil Corp.	9,076,202	$25	25cQ	4-1-41	1.25	1.69	1.43	39⅞	25⅛	45⅛	29¼
63	53¼	55⅝	53⅝	53¾	Humble Oil & Refining	8,987,840	N.P.	37½c	4-1-41	2.00	3.33	3.98	68	47⅛	71	52½
6⅞	5¾	6⅞	6¾	6¾	Imperial Oil of Canada	26,965,078	N.P.	25c	12-2-40	.62½	.71	.96	12⅜	5⅜	17	11⅜
3⅞	3⅜	3⅛	3⅛	3⅛	Indiana Pipe Line	300,000	$7.50	20c	11-15-40	*2.80	.33	.47	7⅜	3	7¼	5⅛
10⅜	8⅞	9⅜	9⅛	9¼	International Petroleum	14,324,088	N.P.	30c	12-21-40	1.25	1.19	1.98	10⅜	8¼	27½	17
2⅝	1¾	2⅛	2⅛	2⅛	Kirby Petroleum Co.	500,000	$1	10c	3-15-41	....	.06	.14	2¾	1⅝	3¾	2⅛
10⅛	9⅜	9⅞	9¾	9⅞	Lone Star Gas	5,518,347	N.P.	20c	4-22-41	.70	.98	.88	10¾	7⅝	10½	7⅛
4⅝	4⅛	4⅜	4¼	4¼	Louisiana Land & Exp.	2,966,762	$1	10c	3-15-41	.35	.22	.45	6¼	3¾	7⅜	4
10	9½	..	..	..	Margay Oil Corp.	149,943	N.P.	25cQ	4-10-41	1.00	1.52	2.28	17	9¼	17	14½
8	7	7½	7⅜	7½	Midwest Oil Co.	998,474	$10	45c	12-16-40	.90	.99	.93	8½	6½	8¾	6⅝
5¾	5⅛	5½	5¼	5¼	Mountain Producers	1,593,584	$10	30cSA	12-16-40	.60	.70	.62	6¼	4⅞	6	4⅞
12⅜	11	12	11¾	12	National Fuel Gas	3,810,183	N.P.	25cQ	1-15-31	1.00	.95	.84	13¼	10	14	11¼
12¾	10¼	10¾	10¾	10¾	National Transit	509,000	$12.50	50c	12-16-40	1.00	.91	.88	12½	8¾	9½	7¼
1⅛	1	..	..	..	New Mexico and Arizona	1,000,000	$1	1c	12-1-37	....	.02	.02	1¼	¾	1⅜	1
7¾	6⅝	..	..	..	New York Transit	100,000	$5	30c	5-15-41	.60	.88	.16	7¾	5¼	6	4
9¾	8¼	..	..	..	Northern Pipe Line	120,000	$10	40c	12-2-40	.80	.31	.24	9⅞	6	7	4½
3⅜	2⅝	3⅞	3½	3½	Pantepec Oil	2,856,872	$1	....	.....	....	....	....	5½	2½	7⅝	4
1½	1	1⅛	1⅛	1⅛	Rcot Petroleum Co.	336,045	$1	25c	2-1-37	....	.70	.17	3¼	1	5	1¼
2½	2⅛	..	..	..	Ryan Consolidated	298,931	N.P.	10c	12-28-40	....	.16	.29	3	1½	3	1⅞
8	7	7⅛	6½	6½	Southern Pipe Line	100,000	$10	25c	3-3-41	.50	.25	—.27	11¾	4¾	4⅞	3½
39¾	37¼	38	37¼	38	South Penn Oil	1,000,000	$25	37½c	3-28-31	2.50	2.84	1.44	44	28	40½	26¾
30½	24½	24½	24½	24½	Southwest Penna. Pipe Lines	35,000	$50	50c	4-1-41	6.50	2.06	—.41	35	21	23	18
20⅜	18	19⅜	18⅝	18⅝	Standard Oil of Kentucky	2,604,790	$10	25c	3-15-41	1.30	1.53	1.45	20⅞	16½	20⅛	17¼
1¾	1⅜	1⅝	1⅝	1⅝	Sunray Oil	1,975,876	$1	5c	12-20-40	.10	.25	.23	2	1⅜	2¾	1¾
3	2¾	3	2⅞	2⅞	Texon Oil & Land	936,024	$2	10c	12-30-40	.40	.49	.56	3⅛	2	4	2⅝
2½	2¼	..	..	..	Transwestern Oil Co.	750,000	$10	....	.....	....	—1.42	.12	3⅜	2	6	2½
⅞	⅝	¾	11/16	¾	United Gas Corp.	7,818,959	$1	....	.....	....	—.55	—.51	2⅛	¾	3⅜	1⅛

*Includes $2.50 capital distribution. †Includes extras. —Deficit.

Personal Paragraphs

R. E. EASTON, president of the Santa Maria Gas Co. has been elected a director of the Southern Counties Gas Co., succeeding FRED CHAMPION, who recently retired from the board.

W. H. FLOOD, JR., petroleum engineer for the Railroad Commission at Corpus Christi, Tex., has resigned to accept a position with the W. R. Davis, Inc., recycling plant at Alice, Tex.

C. M. BRYSON has been named manager and A. J. BLACKARD field manager of the Toronto Pipe Line Co.'s new office at Grayville, Ill. The two will have charge of the purchase of crude oil from nearby fields for shipment to Canada.

CHARLES E. McCARTNEY, of Petrolane Corp. at Long Beach, has been elected president of the Pacific Coast section of Liquefied Petroleum Gas Association at the association's annual meeting held in Stockton, Calif. Mr. McCartney succeeds C. L. PARKHILL of Parkhill-Wade.

J. H. S. BONNER, Wichita Falls, Tex., president of the Bonner Co. and Stayton Oil Co., has been elected president of the Wichita Falls Country Club.

RHEA SMITH, land man with the Carter Oil Co., Jackson, Miss., is a member of the committee formed to arrange the Chamber of Commerce sponsored Oil Men's Banquet in Jackson, March 27.

GEORGE W. STRAKE, Houston, Tex., discoverer of several Gulf Coast fields, including Conroe in Montgomery County, Texas, has been made a member of the seven-man board appointed by the mayor to manage the Houston Exposition and Convention Hall.

G. C. MacDONALD, Tulsa, Gulf Refining Co., production engineer, recently went to Michigan to work on the 1 Bateson, Bay County wildcat, which has had some interesting difficulties. At the present time the well is being sidetracked and close supervision of the drilling fluid is necessary.

J. S. BRIDWELL, Wichita Falls, Tex., president of Bridwell Oil Co., is again exhibiting ribbons captured by his Hereford entries at the Fort Worth, Tex., stock show. A half interest in one of the bulls shown by Mr. Bridwell was sold to the Milky Way farms of Pulaski, Tenn., for $4,000.

WALTER C. TEAGLE, chairman of Standard Oil Co. (New Jersey) was one of the 11-man National Defense Mediation Board appointed by the president last week to seek harmony between labor and industry in defense industries.

HARRY GRAHAM, traffic manager for the Standard Oil Co. of Louisiana, has been made special assistant to the traffic manager of the Standard Oil Co. of New Jersey, involving his transfer from Baton Rouge, La., to New York City. SAM B. SHORT succeeds to the Baton Rouge post.

CAPT. WILLIAM L. EVANS, a veteran of the marine service of the Atlantic Refining Co., will command the new tanker, the S.S. E. H. Blum, when that vessel goes into service April 1 between Philadelphia and Texas ports. EDGAR L. LINDENMUTH will become chief mate; WILLIAM C. SHUMAN chief engineer, and DAVID W. RAPPAPORT first assistant engineer.

ROY E. COLLOM, vice president of Continental Oil Co. and president of California Oil and Gas Association, has announced that GEN. HUGH S. JOHNSON will be guest speaker at the association's first dinner meeting of 1941, to be held in Los Angeles April 3 in the Biltmore Hotel.

PAUL HUNTER, chief geologist in the Gulf Coast division for Shell Oil Co., Inc., Houston, Tex., has resigned to enter into business for himself. Mr. Hunter has been associated with the Shell for the past 12 years.

S. RUSSELL CASEY, geologist for the Woodley Petroleum Co., Houston, Tex., and RALPH CANTRELL of the Lane Wells Co., Houston, Tex., discussed the Davis sand lens of the Hardin field, Liberty County, before the Houston Geological Society the past week.

PARKER L. MELVIN, president of the Penn Grade Crude Oil Association; A. E. BOOTH, vice president; and DON T. ANDRUS, FLOYD W. CLINGER and W. J. BRUNDRED, directors, have been appointed as a committee to study the interstate oil compact with a view to recommending action by the Pennsylvania Legislature.

L. I. MISTROT, petroleum engineer with Arkansas Fuel Oil Co., has been transferred from East Texas to Alice, where he is district engineer. He is succeeded as district engineer in East Texas by LAWRENCE FENNELL, transferred from the Shreveport, La., district. W. L. STANTON has been named district engineer in Shreveport, and JACK RUMP has been transferred from the Rodessa district to Olla, La., as district engineer.

Do You Remember?

From The Oil and Gas Journal Files

25 YEARS AGO

The Bureau of Mines has licensed 10 oil companies to use the Rittman gasoline process, imposing the requirement that all improvements will be assigned back to the government agency.

Interest growing among Mid-Continent oil men in the use of steel derricks.

Representative Treadway of Massachusetts demanded an investigation by the Department of Justice on the production, transportation and sale of gasoline.

Great Britain is considering a rationing system on use of gasoline.

20 YEARS AGO

Commercial manufacture of alcohol from petroleum gases started at Bayway, N. J.

Tariff proposed to arrest "flood" of Mexican crude oil arriving in this country at the rate of 500,000 bbl. daily, exceeding production of Texas, Oklahoma and Kansas.

10 YEARS AGO

Oklahoma's production increased 62,000 bbl. and the allowable of the Oklahoma City field was increased from 90,000 bbl. daily in March to a new high of 125,000 bbl. daily in April.

Texas Railroad Commission sidestepped the issue of applying proration to the East Texas field. Development at that time indicated the productive acreage would cover 60 to 90 sq. miles.

L. P. Garrett, Gulf Oil Corp. geologist, elected president of the A.A.P.G.

EDGAR BOWLES, Geological Survey of Alabama, is again checking Alabama wildcat operations after an illness of several weeks.

W. B. POWELL, Fort Worth, Tex., producer, has organized the Combined Oil Co. which is soon to start its first test on a 1,000-acre block in Throckmorton County, Texas.

C. S. LYNCH, New York, executive vice president of Arkansas Power & Light Co., attended the Arkansas Conservation Commission hearing at Magnolia, Ark., last week.

J. L. TILLERY, Longview, Tex., oil operator in the East Texas district, has been commissioned a major of infantry in the Texas Defense Guard and assigned to duty as commander of the Thirty-second Battalion with headquarters at Longview.

MIKE LOWRANCE, Ardmore, Okla., land man for Sinclair Prairie Oil Co., and his brother, ARCH LOWRANCE, Houston, Tex., independent operator, were called to Thayer, Kans., last week by the death of their mother.

R. E. PORTER, Sawyer City, Pa., has purchased the one-half interest in 25 acres of the Philo Ackley farm in Foster Township, McKean County, Pennsylvania, which contains 16 producing wells. The interest was previously in the hands of the Commercial National Bank.

E. V. FORAN, consulting engineer of Houston, Tex., addressed the student section of A.I.M.E., University of Texas, recently on "Marginal Properties in Distillate Production."

ARNOLD S. BUNTE, formerly geologist with the Heller Co. in Tulsa, has resigned to become chief geologist for Vickers Petroleum Co. at Wichita, Kans.

ED JOHNSON, geologist for the Ohio Oil Co., has been transferred from St. Joseph, Mo., to Falls City, Neb., where the company has recently acquired production and acreage.

W. M. PEDEN, district engineer for the U. S. Geological Survey at Great Falls, Mont., is back at his desk following a short session in the hospital where he underwent a minor operation.

FREDERIC MELLEN, the young geologist credited with discovery of Mississippi's Tinsley field, and his partner, RAYMOND GEAR, are now operating in Colbert County, Alabama.

EMERSON G. SMITH, supervisor of publications for the Continental Oil Co., will remain away from his Ponca City, Okla., office for another 10 days while on a company business trip.

J. BENNETT HILL, of, Atlantic Refining Co.; GUSTAV EGLOFF, of Universal Oil Products Co.; C. R. WAGNER, of Pure Oil Co.; PER K. FROLICH, of Standard Oil Development Co.; E. C. WILLIAMS, of Shell Development Co., and J. C. MORRELL, of Universal Oil Products Co., are some of the men in active petroleum research who will take active parts in the series of research conferences to be held throughout the summer on Gibson Island, Maryland. The conferences are sponsored by the chemistry section of the American Association for the Advancement of Science.

Foreign Work Extended

Foreign exploratory and producing operations of the Texas Corp. have become the special concern of James Terry Duce. Last fall he was moved to San Francisco, Calif., as vice president of the California Arabian Standard Oil Co., half owned by the Texas Corp. The other half is held by the Standard Oil Co. of California.

Bacharach photo

JAMES TERRY DUCE

Recognition for active interest in work of the Petroleum Division of the A.I.M.E. was accorded Mr. Duce last February when he was elected a director of that organization. He has organized and directed the institute's annual foreign-operations symposium for the past several years.

Mr. Duce was born December 30, 1892, in Worcester, England. He came to the United States as a youth and graduated from the University of Colorado, Boulder, Colo., in 1915 as a geologist. Thereafter, for a few years, he was with the Colorado Geological Survey and Bureau of Mines, also doing teaching work at his alma mater and at Washington University, St. Louis, Mo. Toward the end of the World War he was with the chemical warfare section of the U. S. Army.

Service with the Texas Corp. started in 1919 and since then has been continuous. His first assignment was doing geological work for the company in Colorado but he was soon called to headquarters in New York and most of his work has been directed from that office.

Much of his time in recent years has been devoted to operations in Colombia and Venezuela, where the parent company, through partially or wholly owned subsidiaries, is interested in production and exploratory operations. He was vice president and a director of Colombian Petroleum Co. during early development of the Barco concession.

TOM MARKLEY, Louisiana independent operator, has purchased the Houston, Tex., home of ARTHUR CAMERON, Texas producer, who will soon move to Evansville, Ind.

J. HENDRIX ALPHIN, El Dorado, Ark., representative on the Interstate Oil Compact Commission, addressed the state-wide meeting of the Arkansas Oil and Gas Commission in Magnolia Friday.

TOM BERRYHILL, JR., Herbert Oil Corp., Fort Worth, Tex., addressed the geological society there March 24 on "The Texas Defense Guard," an organization in which he is a first lieutenant in Company B.

J. E. (BRICK) ELLIOTT, who designed the Elliott core-drilling equipment, has resigned from Byron Jackson Co. and will engage in the oil business as an independent operator with headquarters at Houston, Tex.

J. A. MULL, geologist for Republic Natural Gas Co., Wichita, Kans., spoke before the Dallas Petroleum Geologists March 25 on "Stream Channels Applied to the Arbuckle of the Central Kansas Uplift."

ALGER R. SYME, R. M. HESKETT and LLOYD R. JONES, all of Minneapolis, Minn., have organized the Big Lake Oil Co. in Montana and will develop properties in the Big Lake district of that state. The directors are also identified with the Montana-Dakota Utilities Co.

W. D. ANDERSON, C. L. CORNELIUS and W. Y. PENN, all geologists of Midland, Tex., have been appointed as the nomenclature committee of the West Texas Geological Society. The appointments were made during the past week by ROBERT E. KING, district geologist for Shell Oil Co., Inc., and president of the society. The new committee will recommend names to the Railroad Commission for identifying future discoveries as well as small isolated pools in the district.

JOHN R. SUMAN, vice president of the Humble Oil & Refining Co., Houston, Tex., presided at a panel discussion of labor problems there last week participated in by representatives of the National Association of Manufacturers and the Texas State Manufacturers Association.

Shifts: STEVEN J. LEACH, engineer, Humble Oil & Refining Co., from Hobbs, N. M., to Midland, Tex.; W. D. KIRKPATRICK, superintendent, Natural Gasoline Department, Phillips Petroleum Co., from Crane, Tex., to White Deer, Tex.; J. Z. WERBY, Refugio Oil Corp., from Longview, Tex., to San Jose, Costa Rica, Central America; HAROLD L. VALENTINE, president, Vaccars Corp., from New York City to Jersey City, N. J.; TRACY GILLETTE, geologist, Consolidated Oil Corp., from Rochester, N. Y., to Urbana, Ill.; C. DAVIS WRIGLEY, engineer, Atlantic Refining Co., from Philadelphia, Pa., to Upper Darby, Pa.; CARL E. MAGNUSON, geologist, Shell Oil Co., Inc., from St. John, Kans., to Stroud, Okla.; J. F. FUNK, geologist, Ohio Oil Co., from Casper, Wyo., to Findlay, Ohio; R. A. MALOTT, engineer, Shell Oil Corp., from Denver City, Tex., to La Mirada, Calif.; ROBERT D. HANNA, vice president, Mex-Seaboard Oil Co., from Miami, Fla., to New York City.

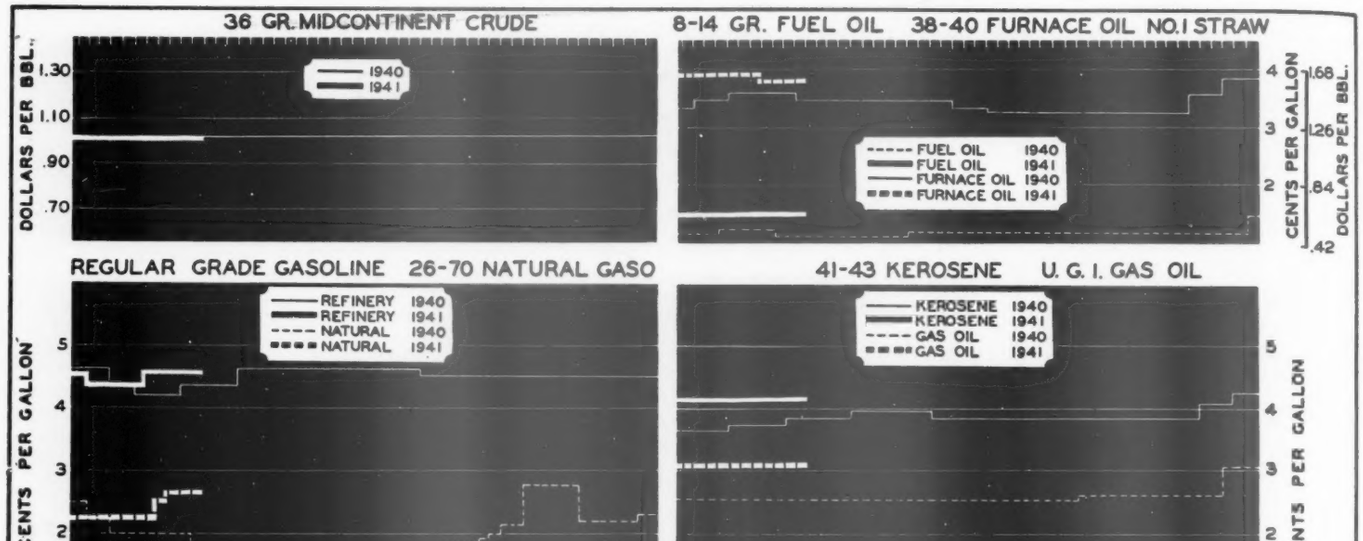
BART W. GILLESPIE, who spent a year with Y.P.F. in Argentina and additional time in Peru and Mexico as a consultant and geologist, has been appointed California sales engineer of the H. & B. Sales Co., of Long Beach.

F. J. ADAMS, Fort Worth, Tex., general agent for Gulf Oil Corp.; M. O. RIFE, production superintendent; M. O. BORING, division superintendent for West Texas; O. C. NEEDHAM, division superintendent for the Panhandle; T. J. HOLLINGSWORTH, chief clerk, and C. S. YOUNGBLOOD, purchasing agent, attended a banquet meeting of 125 foremen and employes at Odessa, Tex., last week. Safety awards were presented to several employes.

A. H. PARKS, land man for Westgate-Greenland Oil Co., is in charge of the company's new land offices opened recently in Wichita, Kans. The land department was formerly officed at Hutchinson, Kans., where JOHN DUNCAN, Kansas superintendent, remains stationed.

F. E. RICE, Phillips Petroleum Co., Bartlesville, Okla., has been named chairman of the 1941 central committee on measuring, sampling and testing natural gas and natural gasoline of the American Petroleum Institute's Division of Production. GEORGE P. BUNN, also of Phillips Petroleum Co., is vice chairman.

LEW F. SONNTAG, independent oil operator of Great Falls, Mont., on April 16 will observe his forty-ninth anniversary in the oil industry, having started to work in the oil fields near Lima, Ohio, in 1892. He and Mrs. Sonntag returned last week from an 8,000-mile automobile trip through the eastern and southern states.



Representative Mid-Continent Quotations on Crude Oil and Refined Products, Basis Oklahoma (Group 3)

Low Side of Inland-Gasoline Market Given Another Eighth-Cent Advance

By H. STANLEY NORMAN

THE low side of the Mid-Continent refinery motor-fuel market is firmly intrenched this week a peg higher on the tedious climb from depths without precedent that have prevailed over much of the first quarter. The margin between low and high motor-fuel quotations is now barely ⅛ cent, against an extreme of ¾ cent that obtained during late December and early January.

Added to the improvement in the refinery gasoline market to turn plant operators more optimistic this week is the ruling of the Interstate Commerce Commission ordering a reduction in railroad rates on petroleum products. There is no unanimity of opinion on the effect of rail-rate reductions, but many operators of small and intermediate-size refineries believe benefits will result. There will be a tendency to draw more distinctly the boundaries of competitive zones, perhaps to the exclusion of certain products that have transgressed across more or less flexible boundaries where previous rates created special conditions. From Tulsa, the Group 3 basing point, the rate reductions ranged between 10 to about 26 per cent.

Volume Increase Sustained

Shipping instructions from contract customers and spot orders from northern jobbers are reaching Mid-Continent refineries in a constantly increasing volume. Gasoline with comparatively low octane rating appears to be in an especially strong position, probably reflecting the demand for tractor fuels. This opinion is borne out by the apparent interest in kerosene and tractor fuel.

Motor-fuel quotations this week were firm at a range of 3¾ cents for low-octane grades to a top of 4⅝ cents on regular 72-74-octane material. The gasoline market is in the strongest position it has occupied since the late summer months of last year. The record-breaking demand appears not to be diminishing in any direction. Estimates of the Bureau of Mines that April motor-fuel demand will run 10 per cent higher than a year ago extends the first-quarter rate well into the season of high consumption.

Indications are that the rate of increase on motor-fuel consumption may subside in the summer months, but there is no discounting the assurance that demand will exceed 1940 requirements by a substantial margin.

Light fuel oils are softening gradually, although shipments from refineries are holding up moderately well. Tank-wagon prices were reduced ¼ cent per gallon in the Chicago district last week by Standard Oil Co. (Indiana) and other large marketers. Residual fuels, on the other hand, are holding their strong market position without difficulty. In fact, residual-fuel demand is substantially in excess of supplies in the inland refining district.

Refined Oil Market Barometer

An eighth-cent advance on the low side of the Mid-Continent refinery gasoline market places motor fuel in position for a general advance. Higher prices on the Gulf Coast are well sustained with indications that exports may exceed some of the more conservative estimates. Gasoline has been raised ¼ cent at several Atlantic Coast terminals.

MID-CONTINENT: Natural gasoline is strong and in position to move higher.

GULF COAST: Distillate fuel oils firm at low of 3 cents.

CALIFORNIA: Residual strong, distillate fuel in strong demand.

PENNSYLVANIA: Most suppliers are quoting wax ¼ cent higher.

CHICAGO: Tank-wagon prices on light fuels reduced ¼ cent.

Lube Demand Higher

Indication of the increase in lubricating-oil demand is contained in the February report on shipments by the Western Petroleum Refiners Association. Shipments of blended oils showed the largest gain over January, totaling 187,086 bbl. in February against 154,826 bbl. in the earlier month. Bright-stock movement totaled 187,223 bbl. against 171,019; viscous neutrals, 187,467 against 165,816; paraffin oils, 67,215 compared to 64,505; and steam-refined stock, 14,953 against 12,032 bbl.

Rail rates, which the I.C.C. declared will constitute reasonable charges from Group 3 points on or before June 11, compared with those now in effect are shown in the following table:

To—	New rates (cents per gal.)	Present rates (cents per gal.)
Kansas City, Mo.	.01452	.01848
Jefferson City, Mo.	.01716	.02178
St. Joseph, Mo.	.01650	.01848
St. Louis, Mo. and E. St. Louis, Ill.	.01914	.02178
Des Moines, Iowa	.01914	.02376
Cedar Rapids, Iowa	.02112	.02574
Fort Dodge, Iowa	.02112	.02640
Iowa City, Iowa	.02112	.02574
Mason City, Iowa	.02244	.02772
Sioux City, Iowa	.02112	.02640
Keokuk, Iowa	.02046	.02376
Dubuque, Iowa	.02310	.02772
Omaha, Neb.	.01914	.02376
Lincoln, Neb.	.01848	.01947
Sioux Falls, S. D.	.02244	.02904
Effingham, Ill.	.02112	.02640
Peoria, Ill.	.02178	.02574
Chicago, Ill.	.02376	.02640
Milwaukee, Wis.	.02574	.02838
Wausau, Wis.	.02772	.03366
Madison, Wis.	.02442	.03036
Green Bay, Wis.	.02706	.03366
Rhinelander, Wis.	.02838	.03564
Minneapolis-St. Paul, Minn.	.02442	.03036
Duluth, Minn.	.02706	.03432
St. Cloud, Minn.	.02574	.03432
Granite Falls, Minn.	.02376	.03036
Marquette, Mich.	.03102	.04158
Escanaba, Mich.	.03036	.04092

East Coast Motor-Fuel Prices Respond to Gulf Increases

By J. P. O'DONNELL

NEW YORK, Mar. 25.—The gasoline market in the East Coast area strengthened further in the late preseason period indicating that the beginning of the normal heavy-consumption period on April 1 will find the industry in this section of the country in good position both statistically and pricewise. Current prices are low compared with those of a year ago, but indications of improvement based on a strong statistical position are expected to result in substantially improved prices in the near future.

Motor fuel in the 72-74-octane range in the New York Harbor district is now held at a minimum of 5.75 cents, tank car, an increase of ¼ cent from the low that previously prevailed. Despite this improvement these prices are still approximately ¾ cent under those of late March last year. Steady price improvement on the Gulf Coast and record consumption in the marketing area supplied by East Coast refiners and marketers will undoubtedly narrow the spread between 1940 and 1941 prices.

The strong statistical position of motor fuel on the East Coast is revealed in the last U. S. Bureau of Mines report. This report shows that consumption in the East Coast area increased about the same as in other sections of the country despite the fact that severe weather conditions would be expected to delay improvement in this area. Estimated increase in consumption in the market supplied from the East Coast either by production from district refineries or by receipts from the Gulf Coast and California in January 1941 over the same month of last year is 12.1 per cent against 12.3 per cent for the country as a whole.

Consumption in this area is estimated at 15,500,000 bbl. for January of this year against 13,775,000 bbl. for January 1940, an increase of 1,700,000 bbl. The East Coast district called on the Gulf for supplies to meet this demand more heavily than in the previous year as coastwise shipments increased more than 2,500,000 bbl. over January of last year. This was necessitated to some extent also by the heavy demand for fuel oil which required East Coast refiners to expand heating-oil production at the expense of gasoline.

Equally as significant as the marked increase in demand is the improved inventory position of gasoline on the East Coast. While stocks, as shown by the Bureau of Mines report, totaled 19,736,000 bbl. on January 31, 1941, against 19,559,000 bbl. on the corresponding date of 1940, they were substantially lower on a demand basis. On the basis of indicated demand for January last year stocks at the end of that month were equivalent to 44 days' supply, whereas on January 31 this year, on the same basis, they were equal to but 40 days' supply, or close to 10 per cent less.

Expectations are that receipts from the Gulf will continue heavy, for so far there have been no indications of an easing off in demand. This belief is substantiated by the fact that a large Gulf refiner recently switched a unit from the manufacture of aviation gasoline to the production of motor fuel.

While regular grade, unbranded gasoline is improved, branded grades have not been advanced in the last few weeks. Branded motor fuel continues to be quoted at a range of from 6.75 to 7.1 cents per gallon along the eastern seaboard north of Baltimore. The New York Harbor price is 7.1 cents, Boston 6.8 cents, and Philadelphia 7 cents.

Lubricating oils and wax shared the recent improvement with gasoline. White crude-scale wax is reported bringing 3 cents per pound for the higher-melting-point grades and demand is strong. Demand for wax of 124-6 A.m.p. is sufficiently strong that refiners are reprocessing lower-melting-point material. Quotations on white and yellow scale of 122-4 A.m.p. are reported at 2.75 cents.

The Pennsylvania lubricating-oil market continued its rise with higher quotations being posted on bright stock and filterable steam-refined stock. At least one marketer advanced bright-stock prices a full cent on 25-pour material to 15 cents. A corresponding improvement in lower-pour-point bright stocks would make their prices 16.5 and 17.5 cents. It was also reported that 650 steam-refined stock was being held for 9.5 cents, an increase of ½ cent from previous quotations.

January's 15 per cent increase in domestic demand for lubricating oils is indicative of the trend that has resulted in better lube prices. An even larger demand that may be sufficient to offset entirely the loss of exports is anticipated by some suppliers. Higher crude costs have also been a factor in the lube-oil improvement. Export demand, however, continues at a low ebb and one large supplier reports that he has not made an export quotation for more than 6 months. Currently posted export prices are nominal and published prices, due in part to the high cost of packaging, are held by some to be lower than those at which actual transactions could be made.

Demand for heating oil is definitely tapering off though the cold weather that prevailed throughout the eastern part of the country during the early part of last week resulted in some of the heaviest demands on suppliers of the entire season. The return to more-moderate temperatures late in the week was accompanied by a slowing up in consumption that resulted, according to some reports, in the resumption of price shading. However, No. 2 fuel oil still continues to be quoted by major suppliers at 4 cents in the New York Harbor market and from that low to 4.3 cents at Boston and 4.4 cents at Portland.

Gulf Coast Sellers Maintain Price Gains

HOUSTON, Tex., Mar. 25.—Rising optimism permeated the Gulf Coast refinery and light fuel-oil markets this week as sellers continued to maintain gains made recently. Although there were no further advances in prices, and there was no additional major spot buying, there was no sign of recession. On the other hand, there were prospects that gasoline prices would again move upward.

Practically all major marketing companies in the district have met the advances in dealers' prices initiated early last week in the state, which has clarified the previously unsettled retail situation. Although the retail outlets in this area represent only a minor portion of the Gulf Coast refinery market, the advances readily reflect the general improvement.

Refinery prices for gasoline now are 1½ cents above the levels to which the market had sagged.

So far as light fuel oils are concerned there is no question of the firmness of the market at a low of 3 cents for No. 2 specification material. However, in view of the approaching close of the consuming season for these products, there is some uncertainty over the prospects. A majority of refiners are in good shape following the relief given several sources the preceding week, and it is considered likely that sellers may be able to maintain present firm prices longer than usual.

Heavy fuels continue steady with little definite trend being indicated.

A.P.I. Weekly Refinery Statistics

Week Ended March 22, 1941

	Capacity reporting (per cent)	Total gasoline stocks (bbl.)	Residual fuel-oil stocks (bbl.)	Gas oil and distillate stocks (bbl.)	Daily crude runs (bbl.)
East Coast	100.0	20,971,000	7,688,000	9,068,000	589,000
Appalachian	91.0	3,237,000	461,000	381,000	131,000
Ind., Ill., and Ky.	90.2	19,589,000	2,910,000	2,425,000	604,000
Okla., Kans., and Mo.	76.9	8,886,000	1,902,000	1,239,000	281,000
Inland Texas	59.6	2,321,000	1,433,000	323,000	122,000
Texas Gulf	89.2	15,100,000	6,899,000	5,071,000	868,000
Louisiana Gulf	97.6	3,442,000	2,412,000	1,024,000	136,000
N. Louisiana and Ark.	51.5	542,000	535,000	301,000	48,000
Rocky Mountains	56.0	1,708,000	481,000	169,000	57,000
California	87.3	16,705,000	69,218,000	10,074,000	483,000
Total reported	86.2	92,501,000	93,939,000	30,075,000	3,319,000
Est. unreported	.....	7,040,000	1,650,000	520,000	336,000
*Est. total	.....	†99,541,000	95,589,000	30,595,000	3,655,000
*Est. total previous wk.	.....	98,979,000	96,661,000	31,643,000	3,550,000
*March 23, 1940	.....	102,428,000	102,939,000	23,537,000	3,560,000

*Bureau of Mines. †Includes 6,438,000 bbl. aviation stocks.

Stocks of Crude Oil in the United States

(BUREAU OF MINES ESTIMATE)

Week ended March 15, 1941	264,304,000 barrels
Week ended March 8, 1941	264,001,000 barrels
Week ended March 16, 1940	246,762,000 barrels

Figures do not include stocks of heavy, unrefinable California crude.

RETAIL OIL MARKETS...

Tank-wagon and filling-station prices on gasoline and kerosene furnished by larger marketing firms

Prices as of March 25, 1941

Taxes

The gasoline quotations given in the following tables include the 1½-cent federal tax, as well as state, county, and city taxes. The gasoline is the regular or standard grade. In most areas lower grades and a premium grade also are available.

Standard Oil Co. (Indiana)

	Gasoline Tank wag.	Dlr.	Incl. tax	Kero. tank wag.
Chicago, Ill.	14.6	12.6	4.5	10.0
Decatur	14.6	13.1	4.5	9.5
Joliet	15.6	14.1	4.5	10.0
Peoria	15.6	13.2	4.5	10.0
Quincy	15.4	13.9	4.5	9.8
Davenport, Ia.	15.6	14.1	4.5	‡10.0
Des Moines	15.4	13.9	4.5	‡9.8
Mason City	15.8	14.3	4.5	‡10.2
Duluth, Minn.	16.4	14.9	4.5	10.8
Mankato	16.0	14.5	4.5	9.5
Minneapolis	16.0	14.2	4.5	10.4
LaCrosse, Wis.	17.0	15.5	5.5	10.4
Green Bay	17.4	15.9	5.5	10.8
Milwaukee	16.8	15.3	5.5	10.2
Detroit, Mich.	14.1	12.6	4.5	8.1
Grand Rapids	14.3	12.8	4.5	9.1
Saginaw	14.9	13.4	4.5	9.1
Evansville, Ind.	16.6	14.4	5.5	†9.8
Indianapolis	16.8	14.8	5.5	†10.0
South Bend	16.8	15.3	5.5	†10.0
Fargo, N. D.	18.2	16.7	5.5	11.6
Huron, S. D.	17.5	16.0	5.5	10.9
Kans. City, Mo.*	14.9	11.9	4.5	8.6
St. Louis*	14.7	13.2	4.5	9.6
St. Joseph	14.9	13.0	4.5	8.4
Wichita, Kans.	13.8	12.3	4.5	7.2

*State tax 2 cents, 1-cent city tax, and 1½-cent federal tax. †Does not include 4-cent state tax. ‡Does not include 3-cent state tax.

Exclusive of state general sales taxes.

Discounts to commercial consumers. On purchases per month off tank-wagon prices: 1,000 gal. or more, 1.5 cents off, minimum delivery 25 gal.

Stanolex Fuel Oil in Chicago

Effective Mar. 19, 1941, f.o.b. Chicago, tank-wagon prices: Standard heater oil, 1-99 gal., 9.0 cents; 100-149 gal., 8.0 cents; 150 gal. and over, 7.5 cents. Stanolex fuel oil No. 1, 1-99 gal., 8.25 cents; 100-399 gal., 7.25 cents; 400 gal. and over, 6.75 cents. Stanolex furnace oil, 1-99 gal., 8.25 cents; 100-399 gal., 7.25 cents; 400 gal. and over, 6.75 cents. Stanolex fuel oil A, 1-399 gal., 6.0 cents; 400-790 gal., 5.0 cents; 800 gal. and over, 4.75 cents. Stanolex fuel oil B, 1-399 gal., 6.0 cents; 400-799 gal., 5.0 cents; 800 gal. and over, 4.75 cents. Stanolex Bunker C fuel oil, 1-999 gal., 4.75 cents; 1,000 gal. and over, 3.75 cents.

Ohio

STANDARD OIL CO. OF OHIO

	Gasoline Cons'r tank wag.	Dl- vided dlr.	Incl. tax	Kero. tank wag.
Ohio points	16.0	15.0	5.5	*9.0

*Includes state tax of 1 cent.

Atlantic Coast District

STANDARD OIL CO. OF NEW JERSEY

	Gasoline Cons'r tank car	Dlr. tank wag.	Incl. tax	Kero. tank wag.
Atlantic City	11.30	12.60	4.5	7.2
Newark	11.30	12.60	4.5	7.2
Annapolis, Md.	12.85	14.35	5.5	9.5
Baltimore	12.25	13.75	5.5	8.0
Cumberland	13.65	15.15	5.5	10.0
Washington, D.C.	10.50	12.00	3.5	9.0
Danville, Va.	14.45	16.95	6.5	9.0
Norfolk	13.25	15.75	6.5	9.5
Petersburg	13.55	16.05	6.5	10.5
Richmond	13.55	16.05	6.5	10.5
Roanoke	14.75	17.25	6.5	10.0
Charles'n, W. Va.	14.05	16.55	6.5	11.5
Parkersburg	13.35	15.85	6.5	11.2
Wheeling	14.35	15.40	6.5	11.8
Charlotte, N. C.	16.40	16.50	7.5	9.8
Hickory	16.95	18.45	7.5	9.7
Mt. Airy	16.80	16.00	7.5	10.4
Raleigh	16.15	17.00	7.5	9.7
Salisbury	16.45	15.50	7.5	10.1
Charleston, S. C.	14.25	16.75	7.5	9.25
Columbia	15.10	17.60	7.5	(*)
Spartanburg	15.80	18.30	7.5	(*)

Price basis to Essolene undivided dealers: Dealer tank-wagon price less 0.5 cent per gallon. Price basis to commercial consumers, effective March 8, 1937, in Maryland, District of Columbia, and in Arlington and Fairfax counties in Virginia and March 12 in New Jersey: To contract accounts purchasing at least one full compartment at a time by hose connection, on yearly purchases: From 2,500 to 100,000 gal., consumer tank-wagon price at time and place of delivery: 100,000 gal. per year, consumer tank-car price plus 0.5 cent per gallon. Consumer tank-wagon price generally will be equivalent to dealer tank-wagon price less 0.5 cent per gallon.

Effective January 16, 1939, in North Carolina the commercial consumer schedule became as follows: Single deliveries of 50 gal. or more, consumer tank-wagon price. Single deliveries of less than 50 gal., 4 cents per gallon over consumer tank-wagon price. Generally the posted consumer tank-wagon price will be equivalent to the dealer price, less 0.5 cent per gallon. The above policy also applies in South Carolina, effective January 23, 1939.

*Kerosene business of the company at these points now exclusively handled by dealers.

Southern District

STANDARD OIL CO. (KENTUCKY)

	Gasoline Cons'r tank wag.	Net dlr.	Incl. tax	Kero. tank wag.
Atlanta, Ga.	15.0	15.0	7.5	9.0
Augusta	16.0	16.0	7.5	9.5
Macon	15.0	15.0	7.5	9.0
Savannah	15.5	15.5	7.5	9.0
Birmingham, Ala.	16.5	16.5	8.5	8.0
Mobile	17.0	17.0	9.5	8.0
Montgomery	18.0	18.0	9.5	10.0
Jackson, Miss	13.0	13.0	7.5	9.0
Vicksburg	15.5	15.5	7.5	8.5
Jacksonville, Fla.	16.0	16.0	8.5	8.0
Miami	16.0	16.0	8.5	8.0
Pensacola	17.0	17.0	9.5	8.0
Tampa	16.0	16.0	8.5	8.0
Lexington, Ky.	15.5	15.5	6.5	9.0
Covington	13.5	13.5	6.5	9.0
Louisville	15.0	15.0	6.5	8.5
Paducah	12.5	12.5	6.5	8.5

Price basis to tank-wagon consumers, effective January 4, 1937, 3 cents per gallon below tank-wagon price.

Montgomery, Ala., has a county tax of 1 cent per gallon, and a city tax of 1 cent per gallon on gasoline, in addition to state tax, and 1 cent per gallon on kerosene. Mobile, Ala., has a city gasoline tax of 2 cents per gallon: Birmingham, Ala., has a city gasoline tax of 1 cent per gallon; Pensacola, Fla., has a city gasoline tax of 1 cent. All are included in the table.

Pennsylvania and Delaware

ATLANTIC REFINING CO.

	Gasoline Cons'r tank car	Dlr. tank wag.	Incl. tax	Kero. tank wag.
Philadelphia, Pa.	12.5	13.5	5.5	9.5
Pittsburgh	13.0	15.0	5.5	10.5
Allentown	13.0	14.5	5.5	10.5
Erie	12.5	15.0	5.5	10.0
Scranton	13.0	14.5	5.5	10.5
Altoona	13.0	15.0	5.5	10.5
Dover, Del.	...	14.0	5.5	10.5
Wilmington	...	13.5	5.5	10.0

Price basis to undivided dealers, dealer tank-wagon price less 0.5 cent per gallon.

Discount on kerosene, 2 cents per gallon off tank-wagon price on tank-wagon deliveries of 25 gal. or more at one time.

Pacific Coast Territory

STANDARD OIL CO. OF CALIFORNIA

	Gasoline Tank truck	Serv. sta.	Incl. tax	Kero. tank wag.
San Francisco	16.5	17.5	4.5	11.5
Los Angeles	16.0	17.0	4.5	10.0
Fresno, Calif.	17.5	18.5	4.5	12.5
Phoenix, Ariz.	20.5	21.5	6.5	*17.5
Reno, Nev.	19.5	20.5	5.5	13.5
Portland, Ore.	19.0	20.0	6.5	13.5
Seattle, Wash.	19.0	20.0	6.5	13.5
Spokane	20.5	21.5	6.5	16.5
Tacoma	19.0	20.0	6.5	13.5

*Includes 5-cent state tax.

Discount to dealers: On gasoline, off tank-wagon price, to 100 per cent dealers, 3 cents. To commercial consumers: On tank-wagon price; on single deliveries of 40 gal. and over, advance quantity discount extended at time of delivery, 3 cents. Service-station schedule applies on single deliveries less than 40 gal. On kerosene in tank-car, transport-truck, and trailer delivery, 3 cents off tank-wagon price; plant deliveries to jobbers, 2.5 cents below tank wagon.

March 18, 1939, split dealer discount was canceled.

New York and New England

SOCONY-VACUUM OIL CO., INC.

	Gasoline Cons'r tank car	Dlr.* tank wag.	Incl. tax	Kero. tank wag.
Albany	13.1	13.8	5.5	7.3
Met. New York	12.8	13.0	5.5	7.3
Buffalo	13.3	13.5	5.5	8.0
Rochester	13.5	13.7	5.5	8.6
Syracuse	12.8	12.0	5.5	8.5
Portland, Me.	12.7	13.7	5.5	7.5
Manchester, N. H.	13.8	13.0	5.5	8.5
Burlington, Vt.	14.1	14.3	5.5	7.9
Boston, Mass.	11.3	11.8	4.5	7.6
Worcester	11.9	12.0	4.5	7.5
Hartford, Conn.	12.8	13.0	4.5	6.8
New Haven	12.2	12.4	4.5	6.8
Providence, R. I.	11.3	12.4	4.5	7.4

*Undivided.

Effective August 8, 1940, the company changed its commercial consumer policy in New York and New England to the following:

Full compartment deliveries: Accounts buying less than 20,000 gal. annually, 0.5 cent above the commercial-consumer price; accounts buying from 20,000 to 120,000 gal. annually, commercial-consumer price; accounts buying 120,000 gal. annually and above, 0.25 cent off consumer price. Split compartment deliveries: Delivery of less than a full compartment, 250 gal., commercial-consumer price plus 1 cent. Steel-barrel deliveries: Commercial price plus 3 cents.

Rocky Mountain District

CONTINENTAL OIL CO.

	Gasoline Tank wag.	Incl. tax	Kero. tank wag.
Denver, Colo.	14.5	5.5	10.5
Grand Junction	16.5	5.5	12.0
Pueblo	15.5	5.5	9.0
Casper, Wyo.	16.5	5.5	11.5
Cheyenne	13.0	5.5	11.0
Billings, Mont.	16.5	6.5	12.0
Butte	15.5	6.5	13.0
Great Falls	15.5	6.5	12.0
Helena	15.5	6.5	12.5
Salt Lake, Utah	16.0	5.5	14.0
Boise, Idaho	†18.6	6.5	16.0
Twin Falls	†19.6	6.5	16.5
Albuquerque, N. M.	*16.0	7.0	9.5
Roswell	*14.0	7.0	8.0
Santa Fe	‡17.0	7.5	9.5

*Includes city tax of 0.5 cent. †Includes toll-bridge tax of 1 mill. ‡Includes city tax of 1 cent.

Tank wagon represents price to consumers. Dealer represents price to dealers. If no dealer price is quoted, the tank-wagon price applies to all classes of trade.

Central South District

STANDARD OIL CO. OF LOUISIANA

	Gasoline Cons'r tank car	Dlr. tank wag.	Incl. tax	Kero. tank wag.
New Orleans, La.	14.25	16.75	8.5	‡10.0
Baton Rouge	14.75	17.25	8.5	‡10.5
Alexandria	14.75	17.25	8.5	‡10.5
Lafayette	15.00	17.50	8.5	‡10.5
Lake Charles	14.75	17.25	8.5	‡10.0
Shreveport	14.00	16.50	8.5	10.0
Knoxville, Tenn.	18.00	20.00	8.5	12.5
Memphis	15.00	17.00	8.5	11.0
Chattanooga	17.50	17.35	8.5	12.0
Nashville	17.00	17.50	8.5	10.0
Bristol	18.25	18.25	8.5	12.0

Essolene at dealer price less 0.5 cent per gallon to undivided dealers.

‡Includes 1-cent state tax.

Price basis to commercial consumers: Effective May 15, 1937, deliveries of 50 gal. or more in one territory take posted consumer tank-wagon price. Accounts taking deliveries of less than 50 gal. at one time pay posted consumer tank-wagon price plus 4 cents per gallon. Generally, the posted consumer tank-wagon price will be equivalent to the dealer price less 0.5 cent per gallon. Kerosene prices include 1-cent state tax.

Effective February 24, 1939, the company reestablished in New Orleans the commercial consumer policy on motor fuel effective in the rest of the state.

Effective December 12, 1938, the company revised its commercial consumer policy on motor fuel in New Orleans, as follows: Single deliveries of less than 50 gal., consumer tank car plus 2 cents per gallon 50 to 199 gal., consumer tank car plus 1 cent per gallon; 200 gal. and over, consumer tank car plus 0.5 cent per gallon.

Oklahoma and Arkansas

CONTINENTAL OIL CO.

	Gasoline Tank wag.	Incl. tax	Kero. tank wag.
Texarkana, Ark.	13.5	5.5	6.0
Fort Smith	13.5	5.5	6.5
Little Rock	16.0	8.0	8.0
Muskogee, Okla.	13.5	5.5	7.0
Oklahoma City	11.5	5.5	6.5
Tulsa	11.5	5.5	6.0

Tank wagon represents price to consumers. If no dealer price is quoted, the tank-wagon price applies to all classes of trade.

Nebraska

STANDARD OIL CO. OF NEBRASKA

	Gasoline Tank wag.	Dlr.	Incl. tax	Kero. tank wag.
Omaha	17.4	15.9	6.5	9.8
McCook	17.0	14.4	6.5	9.5
Norfolk	17.5	15.9	6.5	9.9
North Platte	17.8	16.0	6.5	10.2
Scottsbluff	17.4	15.0	6.5	10.8

Discounts to commercial consumers for tank-wagon deliveries covered only by standard commercial consumers contract, effective January 1, 1935.

Texas

	Gasoline Tank wag.	Serv. sta.	Incl. tax	Kero. tank wag.
Dallas, Tex.	11.5	15.5	5.5	6.0
Fort Worth	11.5	15.5	5.5	7.0
Houston	12.0	16.0	5.5	8.0
San Antonio	12.5	17.0	5.5	8.0

Naphtha

STANDARD OIL CO. (INDIANA)

	Tank wagon*
Oleum spirits	16.2
V.M.&P. naphtha	16.5
Cleaners' naphtha	15.5
Stanisol	15.5

*Prices include 3-cent Illinois tax but not 1-cent federal tax nor 2 per cent retail occupational tax.

Prices f.o.b. Chicago. Each price subject to discount of 1 cent per gallon for 150-gal. lots if covered by contract.

Canada*

3-Star Imperial Gasoline
IMPERIAL OIL, LTD.

	Gasoline Tank wag.	Incl. tax	Kero. tank wag.
Halifax, N. S.	24.5	10.0	18.0
St. John, N. B.	24.5	10.0	18.0
Montreal, Que.	24.0	8.0	16.5
Toronto, Ont.	24.5	8.0	17.0
Hamilton, Ont.	24.5	8.0	17.0
Winnipeg, Man.	27.5	7.0	22.5
Brandon, Man.	28.0	7.0	22.5
Regina, Sask.	25.0	7.0	20.0
Saskatoon, Sask.	20.8	7.0	22.8
Edmonton, Alta.	25.9	7.0	20.0
Calgary, Alta.	23.0	7.0	18.0
Vancouver, B. C.	21.0	7.0	23.0

*Imperial gallon used in Canada.

Divided dealers pay tank-wagon prices. Discount to undivided dealers, 1 cent below tank-wagon price. In Maritime Provinces both divided and undivided dealers pay tank-wagon price.

Tank-Wagon Changes

Standard Oil Co. (Indiana) reduced the tank-wagon price of No. 1 fuel oil in Chicago 0.25 cent per gallon, effective March 19.

Standard Oil Co. of New Jersey reduced kerosene tank-wagon prices 0.2 cent per gallon at Mt. Airy, Raleigh and Salisbury, N. C., on March 17.

Standard Oil Co. (Kentucky) reduced the tank-wagon and dealer price of regular gasoline 1 cent at Jackson, Miss., March 11.

Continental Oil Co. reduced the tank-wagon price of regular gasoline 1 cent at Tulsa February 27 and increased 1 cent to all classes of trade at Cheyenne, Wyo., on the same day.

Standard Oil Co. of Louisiana reduced the dealer tank-wagon price on regular gasoline 0.5 cent per gallon March 14 at Bristol, Tenn.

PRICES OF REFINED PRODUCTS...

All quotations f.o.b. plant in cars for interstate or export movement except as otherwise noted

Prices as of March 25, 1941
(Most prices in cents per gallon)

The quotations are exclusive of the federal excise taxes of 1 cent a gallon on gasoline and 4 cents a gallon on lubricating oils. Octane ratings in Middle West, Mid-Continent, and Southwest are based on A.S.T.M. method of testing.

Refinery Gasoline

OKLAHOMA (Group 3)—

U. S. Motor grades:		
72-74 octane (regular)	.04½	.04⅝
63-66 octane	.04⅛	.04¼
60 octane and below	.03¾	.03⅞
60-62 400 grades:		
72-74 octane (regular)	.04½	.04⅝
63-66 octane	.04⅛	.04¼
60 octane and below	.03¾	.03⅞

NORTH TEXAS—

U. S. Motor grades:		
72-74 octane (regular)	.04⅜	.04½
63-66 octane	.03⅞	.04⅛
60 octane and below	.03⅝	.03¾
60-62 400	.03⅝	.04½

NORTH LOUISIANA (Ark. and N. La. delivery)—

U. S. Motor grades:		
72-74 octane (regular)	.04⅜	.04½
63-66 octane	.03⅞	.04⅛
60 octane and below	.03¾	.03⅞

ARKANSAS (Ark. and N. La. del.)—

U. S. Motor grades:		
72-74 octane (regular)	.04⅜	.04½
60 octane and below	.03⅝	.03¾

CHICAGO (Based on Group 3)—

U. S. Motor grades:		
72-74 octane (regular)	.04½	.04⅝
63-66 octane	.04⅛	.04⅜
60 octane and below	.03¾	.03⅞
60-62 400 grades:		
72-74 octane (regular)	.04½	.04⅝
63-66 octane	.04⅛	.04¼
60 octane and below	.03¾	.03⅞

PENNSYLVANIA (inland refineries)—

74-76 octane (regular)	.06
72-74 octane	.05⅝

CALIFORNIA (domestic movement)—

58-60 400, 65 oct. and higher	.05½	.07
54-58 U. S. Motor	.04¾	.06¼

EAST COAST (domestic)—

U. S. Motor grades:		
New York (Bayonne)*	.05¾	.06
Philadelphia	.05⅛	.06⅜
Boston	.05⅝	.06⅜
Baltimore	.05½	.05⅞
Charleston, S. C.	.05¾	.06

*All grades of gasoline ⅛ to ¼ cent less for barge shipments. New York Harbor prices are for New York and New England delivery. Prices for New Jersey delivery ¼ cent lower.

GULF COAST (domestic)—

U. S. Motor grades:		
72-74 octane (leaded)	.04¾	.04⅞
70-72 octane (unleaded)	.04¾	.05
68-70 octane (unleaded)	.04½	.04¾
Below 68 octane (unleaded)	.04¼	.04½

Natural Gasoline

OKLAHOMA (Group 3)—

Grade 26-70		.02⅝
Grade 18-55	.03	.03⅛

NORTH TEXAS—

Grade 26-70	.02¼	.02½
Grade 18-55	.02⅝	.02¾

CALIFORNIA—

75-85 375-390	.04½	.05¼

NORTH LOUISIANA (Ark. and N. La. delivery)—

Grade 26-70		.02¼

Tractor Fuel

OKLAHOMA (Group 3)—

40-42 gr., 315-325 l.b.p., 110-flash, 540-550 e.p.	.03½	.03⅝
41-43 gr., 300-320 l.b.p., 110-125 flash, 500-520 e.p.	.03⅝	.03¾
46-48 gr., 210-230 l.b.p., 480-max., e.p.	.03⅞	.04

Kerosene

(All kerosene water white)

OKLAHOMA (Group 3)—

42-44	.04⅛	.04⅜
41-43	.04⅛	.04¼

NORTH TEXAS—

41-43	.04	.04⅛

NORTH LOUISIANA (Ark. and N. La. delivery)—

41-43	.04	.04⅛

ARKANSAS (Ark. and N. La. del.)—

41-43	.04	.04⅛

PENNSYLVANIA (inland refineries)—

46	.05¼	.05½
45	.05⅛	.05¼

CHICAGO (Based on Group 3)—

42-44	.04⅛	.04⅜
41-43	.04⅛	.04¼

CALIFORNIA (Pac. Coast market)—

38-40 high-burning test	.04½	.05½

NEW YORK (Bayonne, N. J.)—

41-43		.046

GULF COAST (domestic)*—

41-43		.03¼

*Barge price ⅛ cent lower.

Furnace Oil

OKLAHOMA (Group 3)—

Range oil	.03⅞	.04⅛
No. 1 prime white, 38-42	.03¾	.04
No. 1 straw, 38-40	.03¾	.04
No. 2 straw, 32-36	.03⅜	.03⅝
No. 3 zero to 10, 28-32	.03¼	.03½

NORTH TEXAS—

No. 1 prime white, 38-42	.03¾	.03⅞
No. 1 straw, 38-40	.03⅜	.03¾

NORTH LOUISIANA (Ark. and N. La. delivery)—

No. 2, 32-36	.03½	.03⅝

ARKANSAS (Ark. and N. La. del.)—

No. 2, 32-36	.03½	.03⅝

CHICAGO (Based on Group 3)—

Range oil	.03⅞	.04⅛
No. 1 prime white, 38-42	.03¾	.04
No. 2 straw, 32-36	.03⅜	.03⅝
No. 3 zero to 15, 28-32	.03¼	.03½

NEW YORK (Bayonne, N. J.)—

*No. 1		.046
*No. 2		.040
*No. 3		.04

*Barge deliveries ⅛ to ¼ cent under above tank-car price.

Gas Oil and Fuel Oil

(Gas oil per gal., fuel oil per bbl.)

OKLAHOMA (Group 3)—

U.G.I. gas oil, under 35	.03⅛	.03¼
No. 5, low pour point, 18-22	.75	.80
No. 6, 15 and above, 8-14	.60	.65

NORTH TEXAS—

U.G.I. gas oil, under 35	.03	.03⅛
No. 5, low pour point, 18-22	.75	.80
No. 6, 15 and above, 8-14	.60	.65

NORTH LOUISIANA (Ark. and N. La. delivery)—

10-14 fuel oil, industrial		.70

CHICAGO (Based on Group 3)—

U.G.I. gas oil	.03⅛	.03¼
No. 5, low pour point, 18-22	.75	.80
No. 5, 15 and above, 18-22	.60	.70
No. 6, low pour point, 10-16	.60	.70
No. 6, 15 and above, 8-14	.60	65

PENNSYLVANIA (inland refineries)—

36-40	.04½	.05

CALIFORNIA—

Los Angeles:		
30-40 gas oil, per bbl.	1.10	1.25
24 plus diesel, per bbl.	1.10	1.25
24 plus diesel (bunkers)	1.20	1.35
12-16 (bunkers at tidewater)	.65	.75
10-16 (cargo lots)	.65	.75
12-17 (tank cars)	.60	.85
10-17 (high sulfur)	.45	.60
San Joaquin Valley:		
10-18 (tank cars)	.50	.70
24 plus diesel, per bbl.	1.10	1.25
San Francisco:		
24 plus diesel, per bbl.	1.35	1.40
24 plus diesel (bunkers)	1.40	1.50
10-16 (bunkers)	.75	.80

GULF COAST—

No. 2 fuel	.03	.03¼
43-47 diesel		.03
48-52 diesel	.03½	.03⅝
53-57 diesel	.03½	.03⅞
58-and-above diesel	.03⅝	.03¾
Diesel bunkers		1.40
Bunker C (bulk cargoes)		.75
Bunker C (bunkers)		.80

NEW YORK (Bayonne, N. J.)—

27 plus, gas oil		.044
28-30 diesel (lighterage 6¼c per bbl.)		1.65
28-30 diesel (tank cars)		.043
Bunker C (to ocean-going ships in N. Y. Harbor)		1.25
Industrial fuel (tank cars)	.0315	.035

Lighterage charge 5c bbl. additional.

Bright and Steam Refined

OKLAHOMA (Group 3)—

200-210 D, 10-25		.18
150-160 D, 0-10		.13⅛
150-160 D, 10-25		.13
100-110 D, 0-10		.13
100-110 D, 10-25		.12½
Steam refined:		
600 dark green (untreated)		.07

PENNSYLVANIA—

Bright Stocks (Pennsylvania Grade No. 8 color, 140-150 at 210, 545-550 flash):		
10 pour point		.17½
15 pour point		.16½
25 pour point		.15
Steam refined:		
600	.09	.10½
650	.09½	.11½
600 flash	.10	.12
630 flash	.11	.12

Neutral Oil

(Vis. at 100° F. except Pennsylvania and color N.G.A.)

OKLAHOMA (Group 3)—

0-10 pour point:		
150-3		.08
180-3		.08½
200-3		.08½
250-3		.10
280-3		.10½
280-4		.10
300-3½		.11
350-3½		.11½
400-3½		.12
500-3½		.12½
600-3½		.13
100-2½ paraffin oil 10-25		.05¼
10-25 pour point:		
200-3		.08
250-3		.09½
280-3		.10
280-4		.09½

GULF COAST—

Pale oils:		
100-3	.05½	.05¼
200-3	.07½	.07¼
300-3	.07½	.07⅝
500-3½	.08¼	.08½
750-3½	.08⅝	.08⅝
1,200-3½	.08⅝	.08⅞
2,000-4		.09
3,000-4		.10½
Red oils:		
200-5-6	.06⅞	.07
300-5-6	.07¼	.07½
500-5-6	.08	.08¼
750	.08⅝	.08½
1,200-5-6	.08½	.08⅝

CALIFORNIA (moving to dom. market)—

Pale oils:		
100-2½-3	.07¼	.08
200-2½-3	.07¼	.08
300-2½-3	.07¼	.08
400-3-4	.07¼	.08
450-3-4	.07¼	.08
550-3-4	.09	.11
600-3-4	.09	.11
Red oils:		
200-4-5	.07¼	.08
300-5-6	.07¼	.08
350-5-6	.09¼	.11½
400-5-6	.09¼	.11½
450-5-6	.09¼	.11½
500-5-6	.09¼	.11½
600-5-6½	.09¼	.11½
700-6½ plus	.09¼	.11½
750-6½ plus	.09¼	.11½
900-6½ plus	.09¼	.11½

PENNSYLVANIA—

150 vis. at 70° F., 3 color, 400-405 flash:		
Zero pour point		.24½
10 pour point		.23½
15 pour point		.22½
25 pour point		.20
200 vis., at 70° F., 3 color:		
Zero pour point		.26½
10 pour point		.25½
15 pour point		.24½
25 pour point		.22

Wax and Petrolatum

(Prices per pound)

OKLAHOMA (Group 3)—

124-126 (A.m.p.) w.c. scale	.02½	.02¾

PENNSYLVANIA (inland refineries)—

122-124 (A.m.p.) w.c. scale	.02¾	.03
124-126 (A.m.p.) w.c. scale	.02¾	.03

NEW YORK—

Wax in bags fully refined:		
125-127 (A.m.p.) wax		.0560
128-130 (A.m.p. wax		.0560
130-132 (A.m.p.) wax		.0585
133-135 (A.m.p.) wax		.0615
135-137 (A.m.p.) wax		.0640
Crude scale:		
124-126 (A.m.p.) w.s.	.02¾	.03
124-126 (A.m.p.) y.s.	.02¾	.03
Petrolatum in barrels, carload lots:		
Dark green	.02500	.02625
Amber	.02375	.02875
Extra amber	.02625	.03250
Lily white	.04375	.05125
Snow white	.05125	.06125
Cream	.03375	.04125

Export Prices

GASOLINE

GULF COAST—

60-62 400	.04½	.05½
61-63 390	.04½	.04⅞
64-66 375	.04⅛	.04⅞

LOS ANGELES—

U. S. Motor grades:		
Above 69 octane	.05½	.05⅝
65-69 octane	.05¼	.05½
60-65 octane	.04½	.05

KEROSENE

GULF COAST—

41-43 water white	.03⅜	.03½

LOS ANGELES—

41-43 water white	.05	.05¼

LUBRICANTS

(Pennsylvania Grade)

NEW YORK (f.a.s. in bbl.)—

Cylinder stocks:	
600 S.R. unfiltered	.18
630 S.R. unfiltered	.18¼
600 flash, S.R.	.18½
650 flash, S.R.	.20
Bright stock:	
Light, 25 pour point	.22

NEUTRAL OIL

200-3 color	.28⅛
150-3 color	.27

PARAFFIN WAX

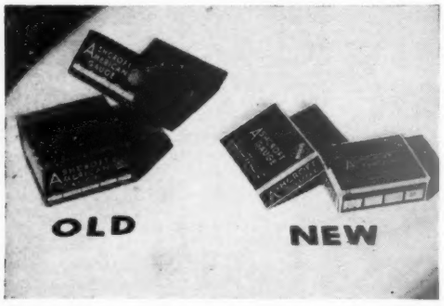
NEW YORK (prices per lb.)—

123-125 A.m.p.		.0560
125-127 A.m.p.		.0560
128-130 A.m.p.		.0585
133-135 A.m.p.		.0615
135-137 A.m.p.		.0640
Crude scale:		
124-126 w.s.	.02¾	.03
124-126 y.s.	.02¾	.03

EQUIPMENT PROGRESS...

New Streamlined Package For Ashcroft Gages

The Ashcroft Gauge Division of Manning, Maxwell & Moore, Bridgeport, Conn., announces a new and



streamlined package for their new line of streamlined gages.

The makers claim that these new stream-lined gages have the same dial sizes as the older type, but have been greatly improved in appearance and reduced in overall size. They state that a comparison can be had between the old and the new gages by comparing the bulky old package with the neat, trim, new package. The new Ashcroft streamlined gages are being packaged in this newly designed streamlined package.

Cincinnati Rubber Enters Multiple V-Belt Field

The Cincinnati Rubber Manufacturing Co., Cincinnati, Ohio, has entered the field of multiple V-belts and can supply all standard sizes as regularly required for multiple V-drives.

Cincinnati V-belts are the modern belts for transmitting power on multiple V-drives, providing a well-balanced drive, smooth running, efficient handling of the power load and uniform construction of every belt in each set.

The construction of Cincinnati V-belts contributes definite advantages to smooth running, long life, and resistance to belt fatigue. A heavy, elastic fabric envelope takes up the outside wear, permits ready flexing and holds tightly to the groove. The load is carried by a cord section of high-tensile, low-stretch cords thoroughly impregnated with liquid rubber and then imbedded in a cushion of rubber providing lengthwise flexibility and easy flexing around the pulleys.

Uniform cross-sections enable each belt to set itself perfectly in the groove. Each belt is matched so that it will carry its equal share of the load. Cincinnati V-belts are offered with the assurance of giving the operator long and satisfactory service. Shipments of all sizes are made promptly.

Sturtevant and Socony Develop New Wax-Manufacturing Process

The B. F. Sturtevant Co., Hyde Park, Boston, Mass., announces the development of a new process for sweating (fractional fusion) of waxes in cooperation with engineers of the Socony-Vacuum Oil Co., Inc. Patents resulting will be jointly held by the two companies. Advantages of this new wax-manufacturing process include greatly improved quality, material reduction in manufacturing time, reduced costs, and increased sales value for the product.

The process consists essentially of an apparatus arrangement and control system by means of which the melted crude-wax mixture is run into pans in a closed room. The room, together with the pans of wax, is air-conditioned by means of the evaporative cooling method of water and air. The wax mass is cooled under close control, each individual constituent freezing separately as cooling proceeds, until pans contain total solids. Then all nonwaxlike oils that might be present drain off, leaving only the wax mixture in solid form. Heating then takes place under absolute control, the temperature rising slowly and pausing just at the right point as each fraction fuses and resulting liquid fraction is drawn off. This continues at the most desirable speed, entirely under time-temperature control, until all waxes up to the highest melting point are gone from the pans.

The apparatus consists of an evaporative cooler, steam-heating unit, circulating fan, distributing ducts in the room, and pipe coils with water pump in the pans. The air is circulated rapidly in the room, cooled or heated as the case may be and the water maintained approximately at the air temperatures.

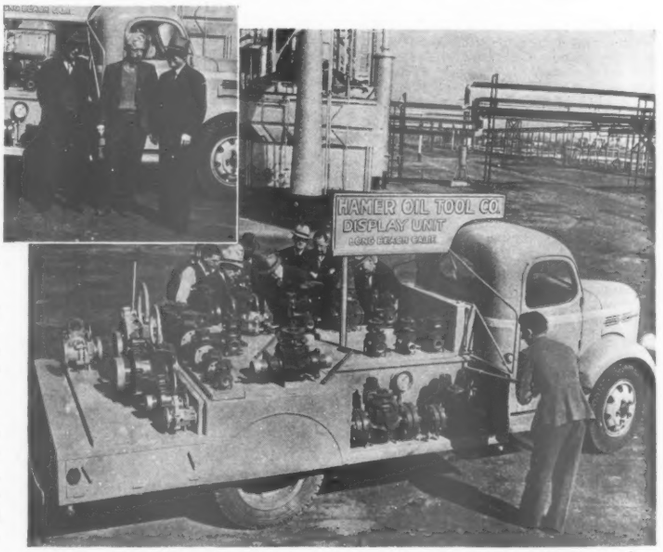
TRADE LITERATURE

NATIONAL TRANSIT PUMP & MACHINE CO., Oil City, Pa.—Bulletin 3401, a 12-page booklet dealing with the company's new line of hot-oil power pumps. Features of the pumps are described and illustrated, and specifications are given. These enclosed-frame hot-oil pumps handle pressures up to 1,500 lb. per sq. in. and liquid temperatures up to 900° F. A table lists complete detail as to sizes and capacities.

AMERICAN METER CO., 60 East Forty-second Street, New York.—Catalog EG-40 on Metric-American Ironcase meters gives a comprehensive, up-to-the-minute report on developments in these types of meters (for both low and high pressures) to meet all requirements and exigencies of present-day service. Design, construction, and maintenance features of regular and special Ironcase meter types are described in detail, and complete specifications presented. Correct use of Westcott-American volume and pressure gages, and Metric-American base-pressure and base-volume indexes, in connection with Ironcase meters, also is discussed.

HAMER OIL TOOL PLACES NEW DISPLAY TRUCK IN OPERATION

Driving the testing rack to the customer wherever he may be is the novel idea behind the new display truck just completed and put on the road by L. S. Hamer, president of the Hamer Oil Tool Co., Long Beach, Calif. The display truck will first make a complete tour of all California drilling and producing areas, covering the field headquarters for drilling and production, and visiting the drilling wells. Refineries, chemical plants, and natural-gasoline plants will also be stopping places on the tour.



Officials of the Wilshire Oil Co. Norwalk refinery recently witnessed a demonstration of the Hamer products right at their plant. Here they are grouped around the new Hamer display truck while an engineer works up pressure against the line blinds. The gentlemen in the insert are, left to right, John Beddow, refinery superintendent; O. E. Liddell, chief engineer, both of the Wilshire Oil Co.; and L. S. Hamer, president of Hamer Oil Tool Co.

Every item in the Hamer line is included in the display. The special platform body has two compartments toward the front, one on either side, which accommodate pressure pumps, gages and piping. On one side are mounted two 6,000-lb. test flanged and geared full-round-opening plug valves, piped so that pressure can be built up in either or both of them to demonstrate the ease of operation of the plug valves under pressure. Pressure can be diverted so that it is all exerted against one side of the closed plug. A visible gage glass shows when the plug is opened against pressure. In the compartment on the opposite side various types of Hamer line blinds are mounted and hooked up to the pressure pump. Operation of the line blinds is demonstrated to prove the Hamer slogan, "A Positive Shutoff Made by One Man in Less Than 1 Minute." Another working display demonstrates the removal of Hamer E-Z out slush-pump valve seats.

The center deck of the display truck carries an array of various types of plug valves, including the new double grease-seal plug valve for use on lines carrying butane and other hard-to-hold liquids and gases. The nonlubricated high-temperature plug valve is included.

All types of Hamer line blinds are displayed on the rear deck in sizes ranging from 1 to 12 in. In addition to the various types of line blinds with which the trade has been familiar for several years, are two types of flanged blinds especially designed for refinery and process-plant applications, as well as for use in drilling areas, on standpipes, mud storage tanks, and in other locations where a simple, inexpensive but quickly operated line blind is desirable. Special emphasis is placed on the line blinds because, according to Mr. Hamer, this now is the most extensive line of equipment of this sort offered by any manufacturer.

New 55-Hp. "Caterpillar" Track-Type Tractors

A new 55-hp. diesel tractor, which has been designed to meet the present-day problem of greater capacity and speed without increased operating costs, has been announced by Caterpillar Tractor Co. The new D6 tractor offers many engineering developments which enable it to do an unusually large quantity of work in relation to its size and horsepower. In addition to mechanical improvements, the efficiency of the machine has been increased by considering the operator's comfort, and by lessening fatigue.

A quantity of features enable the driver to get the most work out of the machine, and at the same time to expend a minimum amount of physical energy. As an example, although the tractor weighs more than 8 tons, it can be steered as easily as an automobile. A separate control unit does the work by hydraulic pressure, when only 14 lb. of pull are exerted on the steering-clutch levers.

The tractor has been "geared to the job" with nine practical working speeds. Five of these are forward, offering a range of from 1.4 to 5.8 m.p.h., with the standard transmission group. For each of these first four forward speeds there is a corresponding, but slightly higher reverse; and the motion of the tractor can be reversed by merely pushing or pulling a single lever. An optional transmission group, giving speeds spaced from 1.7 to 5.3 m.p.h., is available.

In order to obtain greater strength and at the same time to keep weight within the correct limits, welded-steel construction is used extensively. The frame and steering-clutch case are of this construction, and are built into a one-piece unit.

The new tractor is powered by a six-cylinder, water-cooled "Caterpillar" diesel engine, with a bore and stroke of 4¼ by 5½ in., and a full-load governed speed of 1,400 r.p.m. The engine is completely sealed against dust or dirt, and has only two working adjustments—the fan belt and valve clearance.

Cylinder liners and crankshaft journals, as well as many other tractor parts, including track roller shafts and rims, are given a "Hi-Electro" induction hardening treatment, which makes them so hard that a file won't mark them. The crankshaft journals are then superfinished to within a few millionths of an inch.

AMONG EQUIPMENT MEN...

T. M. Johnston on Extended South American Trip

T. M. Johnston, service manager for M. O. Johnston Oil Field Service Corp., Los Angeles, Calif., is on an extended business trip to South America in the interests of his company. He expects to be gone several months, covering Trinidad, Venezuela, and Colombia. Mr. Johnston has been associated with M. O. Johnston Oil Field Service Corp. for the past 7 years in a service capacity. During that time, he has personally supervised over 2,000 formation tests, made under every conceivable condition. His extensive knowledge of Johnston testing methods and equipment will enable him to render much helpful service while on his South American tour.

Ament Represents Inferno Co. in South Louisiana

J. Shelby Ament, residing at 212 High Street, Houma, La., is sales engineer for the Inferno Co. in South Louisiana. Mr. Ament has had several years' experience in oil-field equipment and drilling operations, and is well qualified to install and service all Inferno equipment. He will cover all of the South Louisiana territory for the Inferno Co.

The Inferno Co. recently introduced a new high-velocity steam stack blower for use in oil-field drilling boilers. The blowers furnish sufficient forced draft in the stacks of boilers to operate at 200 per cent capacity on as little as 2 per cent of the steam generated in the boiler.

Another new improved item is the Inferno HC-TOES-A, safety valve. This new-style safety valve is an improvement over the former style, HC-TOES safety valve, in that a new cone steam deflector has been added to the valve cage to deflect the steam away from the spring. The new design permits the building of the valve with an exposed spring for ready inspection at all times. The valve has nickel-alloy valve and seat, stainless-steel stems, cadmium-plated chrome-vanadium springs, and the reversible-lever feature. The valve also has very high relieving capacity, and minimum blow-down, assuring safety in boiler operations.

BUSINESS NOTES

Clarence C. Rausch, who has been associated with the Dearborn Chemical Co. for over 20 years, most of the time having been spent in sales work, has been elected assistant vice president of this company. Mr. Rausch has been active for the past several years in the production of NO-OX-ID pipe-line coatings.

Bob Sivalls will return to take charge of the Black, Sivalls & Bryson, Inc., branch at Jackson, Miss., after spending some months in charge of the company's Ardmore, Okla., branch. He will be replaced at Ardmore by Ed Nelson, formerly with the home sales offices at Oklahoma City. Charlie Williams, formerly with the Black, Sivalls & Bryson, Inc., branch at Alice, Tex., has been transferred to the Odessa, Tex., branch, according to an announcement made by company officials. Mr. Williams replaced Earl Darr, who has been called for military service.

Larkin Appoints Tom Alexander Southern Sales Manager

Larkin Packer Co. announces the recent appointment of Tom E. Alexander as district sales manager of the southern district comprising Texas, New Mexico, Arkansas, Louisiana, and Mississippi. This appointment follows 3½ years of service with Larkin by Mr. Alexander, who has previously been in charge of Houston city sales. Mr. Alexander began his oil-industry career in 1929 in the field in Texas, and his experience covers both field and sales work in the Mid-Continent and Gulf Coast territories.

Alex Brooks Made President Of Chaplin-Fulton Company

Alex M. Brooks was elected president of the Chaplin-Fulton Manufacturing Co. at the annual meeting of the company held January 16. The office became vacant last July, on the death of W. S. Ralston.

A grandson of M. B. Chaplin, one of the Chaplin-Fulton founders, Mr. Brooks is the third member of his family to hold a responsible position with the company. His own active connection began in 1930, on his graduation from Sheffield Scientific School of Yale University. He became treasurer in 1934, on the retirement of his uncle, W. C. Chaplin, and was elected vice president in 1937. His election as president becomes effective at once.

SOUTH AMERICAN OIL INDUSTRY FEATURED IN BROADCAST

Walter Davison of KMPC, the Macmillan Petroleum Corp. radio station in Beverly Hills, Calif., looks on as finishing touches are put on the script of a broadcast dealing with the oil industry of South America, in the interest of the Latin-American trade. This was one of a weekly series of programs, "New World Neighbors." The speakers, seated at the table, are E. L. Decker of Martin Decker Corp.; Albert M. Hill of the Los Angeles Chamber of Commerce, 1941 foreign trade week committee; J. E. Brantly of Drilling & Exploration Co.; W. F. Bettis of M. O. Johnston Oil Field Service Corp.; and Louis Chappuis, petroleum engineer and geologist recently returned from Peru and Chile. Their broadcast pointed out the South American market possibilities for oil-equipment manufacturers, and called attention to the work of the Nomads organization.

CLASSIFIED ADVERTISING

THE MARKET PLACE OF THE OIL INDUSTRY . . .

Patent Attorneys

PATENTS — TRADE MARKS

All cases submitted given personal attention.

Form "Evidence of Conception" with instructions for use and "Schedule of Government and Attorney's Fees"—FREE.

LANCASTER, ALLWINE & ROMMEL
Patent Law Offices
418 Bowen Bldg., Washington, D. C.

CECIL L. WOOD
PATENT LAWYER
Patents, searches and opinions
Infringement practice
Experience in Oil Equipment
323-324 Insurance Bldg., Fort Worth, Tex.
212 Kellogg Building, Washington, D. C.

Leases and Drilling Blocks

LEASES—East Texas, La., South Ark. 20 acres up, dollar acre up.—Owners—Address Attorney. Box 1122, Little Rock, Ark.

EAST TEXAS Woodbine-Trinity sand wildcats starting. Leases afford 10 to 50 for 1 bet. Has already happened past 60 days. E. CROFT, PROCTOR, TEXAS.

FOR SALE Oil and gas leases and small production located in Kentucky shallow field, also tracts of proven Fluorspar and zinc deposits. Reports on request. W. P. HARLEY, Bowling Green, Kentucky.

INVESTIGATIONS, REPORTS AND MAPS
On producing or nonproducing oil land in Louisiana. Nominal fee.
Petroleum Service Bureau
606 Gravier St., New Orleans

WARD-Crane sec. 18B 28, near Silurian test; cheap fee or lease. J. G. Smith, 215 Littlefield Bldg., Austin, Texas.

NEW MEXICO
Oil and Gas Leases and Royalties
ROY G. BARTON, Hobbs, N. M.

HOMER L. FITCH, GEOPHYSICIST AND LOCATION ENGINEER
WHY drill dry holes? Our method only locates structures which contain oil or gas. Drawer 711, Brownsville, Texas.

NEW MEXICO
STATE OIL AND GAS LEASES
FORTY acres and multiples thereof. Near major company lease blocks. Five cent rentals. Ten Year term. Write for information.
HARRY S. WRIGHT
New Mexico State Lessee
Farmington, New Mexico.

FARM Out Proposition, 80, Ellis County, Kan., 80 acre tracts, McLaughlin's new field, N. E. Kan. Harry Haynes, Grantville, Kan.

FOR SALE: 4,000 acres leases north end Fannin County, Texas. 21 miles southeast Cumberland Pool. Bargain. BURTON N. WORK, Box 265, Denison, Texas.

1000 ACRES new gas and oil leases, five cent rentals, under drilling Well now 1100 ft. Five dollars per acre, part or all. Also 35,000 acre block acreage for a test well, northeast Chaves County, Roswell, New Mexico. Wire or write
J. H. FARRAR
Box 364.

LEASES & ROYALTIES. New field in western N. Dakota. Get in now while prices are low. The Willoymer Co., Center, N. Dakota.

WATER FLOODING proven most successful method of recovery. Results outstanding, no failures. Small leases made to produce upwards 400 Bbl. daily. Low cost, high returns. No gamble. 85% of possibilities still in sand after pumping 25 years. Possible to recover 50% of remaining. Have several leases with excellent sand bodies from 400 to 750 feet deep. Write H. B. Snyder, Box 126, Ottawa, Kansas.

Leases and Drilling Blocks

NO DRY HOLE RISK
Five pay strata possible, deepest 1400 feet. Field structurally high and new pool probable. Will assign full seven-eighths working interest 240 acres if you drill one well on it. Snap this, it's good.
H. B. BUDDENBORG
Carlinville, Ill.

1440-A. Oil and Gas Lease in new hot area near major Co. drilling operations, California. Drilling proposition or cash sale. P. O. Box 762, Oakland, Calif.

OIL water flooding offers a sure and profitable return; have drilled leases ready for flooding and good indrilled proven leases ready for coring. H. W. Mitchell, Osawatomie, Kansas.

U. S. OIL RESERVE lands can be filed for lease on limited acreage by American Citizens. Want several join me in filing block in developing Rocky Mountain Area. Big opportunity. Small expense. Box A-346, The Oil and Gas Journal, Tulsa, Okla.

10,000-ACRE BLOCK of leases in recommended Rocky Mountain area. Want good operator to associate in development. Box A-423, The Oil and Gas Journal, Tulsa, Okla.

Mailing Lists

ROYALTY owners, Oil Investors, Unit holders, Stockholders in Oil and Royalty Companies. Personnel lists of every branch of oil industry. All by States. We buy lists. New catalogues ready. Oil Industry Mailing List Co., Tulsa Loan Bldg., Tulsa, Oklahoma.

Business Opportunities

A REAL opportunity if you can finance an oil developing project with $5000 to $10,000, 800 to 2000 ft. Unlimited future. D. H. Reavis, White Bluff, Tenn.

ANTIMONY MINE needs $25,000 for equipment; 24,000 tons ore on dump and blocked out; great demand for same. Give liberal interest. H. Freels, 251 So. Hill St., Los Angeles, Cal.

Help Wanted

LOCOMOTIVE (used) SALESMAN. Acquainted more with Steel Plants and other Industries than Railroads although latter acquaintance naturally that much more desirable. Railway Car experience, similarly. Fixed, so extensive traveling and home absence positively no handicap because entire country his field or market. Drawing account and participation. Obviously, exceptional opportunity for man having positive confidence in his own ability. Others should not waste their time applying because we capable judging all applicants' abilities. Replies inviolably confidential. State entire history and advance necessary. Temperate habits prime requisite. Gentile company. Box A-390, The Oil and Gas Journal, Tulsa, Okla.

Situations Wanted

PRODUCTION SUPERINTENDENT—20 years experience, good references from major company. Go anywhere. Available immediately. Box A-402, The Oil and Gas Journal, Tulsa, Okla.

ATTORNEY, geologically trained, experienced in the oil business, widely acquainted in southwest Texas, desires position with an oil company interested or planning activities in that area. Box A-410, The Oil and Gas Journal, Tulsa, Okla.

SALES EXECUTIVE
Seeks connection with Oil Field Equipment Company.
An established record for producing results.
Well acquainted with executive and operating personnel in Mid-Continent and other fields.
Compensation: Nominal salary, plus commission.
Box A-413, The Oil and Gas Journal.
Tulsa, Oklahoma.

REF. ENG.: Supervisor, 11 yrs. broad and gen. ref. exp. in lubes, naphthas, gasoline, wax, distillation and cracking; now employed, desires change. Exp. incl. research, ref. inspec. chief chem. proc. eng.; ability demonstrated. Reply Box A-411, The Oil and Gas Journal, Tulsa, Okla.

SALESMAN, 7 years' experience in sales department of refineries and brokers wishes to make change. Desires connection in Southwest. Good reference. Address Box A-422, The Oil and Gas Journal, Tulsa, Okla.

MECH. ENGR., 5 years' experience in design, maintenance, and operation of precision instruments. Wishes employment in design or development of oil country equipment. A-400, The Oil and Gas Journal, Tulsa, Oklahoma.

DIESEL Engineer. 8 years' practical experience, operation and maintenance. Experienced Pipe Line Operator. Married. Stationary or free to travel. Reply Box A-421, The Oil and Gas Journal, Tulsa, Oklahoma.

SUPT. process supervisor, chemist, experienced in complete refinery operations desires change. Familiar with distillation, cracking, reforming, polymerization, treating, lube and wax manuf. Proven administrative and technical ability, considerable attention given to cost analysis. Box A-420, The Oil and Gas Journal, Tulsa, Okla.

Geophysical Service

WHY does the needle of the compass point North? Why do the Geese fly North in the Spring How does the Bird Dog point Quail? It must be a natural law in operation. Newton's Law and Relativity are facts. It is a fact that Oil and Gas are located by a Direct Geophysical Method. Locate your next well this way and have a producer, not just a hole in the ground. Gravitational Selector, 14957 Lakewood Heights Blvd., Lakewood, Ohio.

Royalties

ANDREW J. BARRETT
The Philtower
Tulsa, Oklahoma

Brokers—Salesmen

Sell in the most active area in the United States—The Permian Basin of West Texas and Southeastern New Mexico. From the standpoint of royalty investors this area has much to offer. Can supply you with choice non-producing royalties located on geophysical highs. Also drilling blocks, close in acreage to production, or wildcat leases. I maintain my own field men who cover this area for me. All offerings meet the requirements of the Security and Exchange Commission. Inquiries invited.

B. D. BUCKLEY
Paul Brown Bldg., St. Louis, Mo.

Oil Industry Printing

OIL FIELD LEGAL BLANKS
Leases, assignments, releases, township plat books, well records, etc. Request on your letterhead gets free catalog. Olds Press, 215 East Third St., Tulsa, Okla.

Geologic Survey

U. S. and State lists of Geological publications available FREE upon application. Cornwall's Book Store, 723 11th Street N. W., Washington, D. C.

Ranches—Farm Lands

FOR SALE: 480 A. Colo. ranch. Good house, springs, 3 mi. booming twn. 4 mi. $15,000,000 reservoir now building. Wt. title. $4,800. Address Owner, c/o Crit Allen, Lamar, Colo.

WHY not invest in a New Mexico ranch? Have from 2 to 200 sections. Write me for full descriptions.
J. T. TRIGG, Lubbock, Texas.

RANCH BARGAIN
7,000-acre Central Texas ranch on permanent stream, fenced sheep proof, good grass, rock house, convenient to two large cities. No trade. Edwin I. McKellar, Austin, Texas.

SACRIFICE 5,000 A. Rich Colo., Prairie land. 40 to 640 A. tracts. Good titles. $2.50 Acre. Address: Owner, 2644 Rimpau Blvd., Los Angeles.

Incorporations

DELAWARE CHARTERS: Complete service $35. Submitted forms. Chas. G. Guyer, Inc., Wilmington, Delaware.

CAPITAL SEEKERS
Put your project before 260 Key-Men. Cost trifling. Details free. AMSTER LEONARD, Fox Theater Building, Detroit, Michigan.

Legal Blanks

BURKHART'S legal blanks and general forms serving Mid-Cont. oil field since 1908—Okla. Kans. N. Mex. Tex. Ala. Ark. Fla. Ga. Ill. Ind. Ky. La. Mich. Miss. Mo. Neb. N. Dak. Tenn. Wyo. Free catalog samples on request. Burkhart Ptg. & Sta. Co., 115 S. Cinn., Tulsa, Oklahoma.

For Sale—Equipment

4—170 HP TYPE 80 COOPER Direct Driven Compressors Complete. Compressor Cylinders for Cooper, Clark, Bessemer, Ingersoll-Rand & Miller Direct Driven Compressors from 5½ to 26" diameter. 1—60'x162' Sectional Steel Building. 40 HP Superior Gas Engines complete.
NOLAN SALES CORPORATION
Tulsa, Okla. Seminole, Okla.

CROWN BLOCKS: All types light and heavy duty production and cable tool—Real Bargains. Lucey Products Corp., Tulsa, Okla.

CLASSIFIED ADVERTISING RATES

Classified advertising rates: First insertion, 35 cents a line; each additional insertion, 25 cents a line, PAYABLE IN ADVANCE. Six words usually make a line. Count as a word each one-letter word and each group of figures. White-space computed at regular line rate. Allow two extra lines for blind ads. Ads of less than three lines not accepted. No formal acknowledgment is made, and proofs cannot be shown in advance of publication.

	1 time	2 times	3 times	4 times		1 time	2 times	3 times	4 times
3 Lines	$1.05	$1.80	$2.55	$3.30	7 Lines	$2.45	$4.20	$5.95	$7.70
4 Lines	1.40	2.40	3.40	4.40	8 Lines	2.80	4.80	6.80	8.80
5 Lines	1.75	3.00	4.25	5.50	9 Lines	3.15	5.40	7.65	9.90
6 Lines	2.10	3.60	5.10	6.60	10 Lines	3.50	6.00	8.50	11.00

CLASSIFIED DISPLAY RATES

Classified Display is set with a border and may be used in one or two column sizes.

1 Inch	1 time	$5.00
1 Inch	13 times	4.50 per inch
1 Inch	26 times	4.00 per inch
1 Inch	52 times	3.50 per inch

This space may be contracted for over a period of one year from the date of the first insertion and is PAYABLE IN ADVANCE, MONTHLY.

THE OIL AND GAS JOURNAL